ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

OCTOBER 1960

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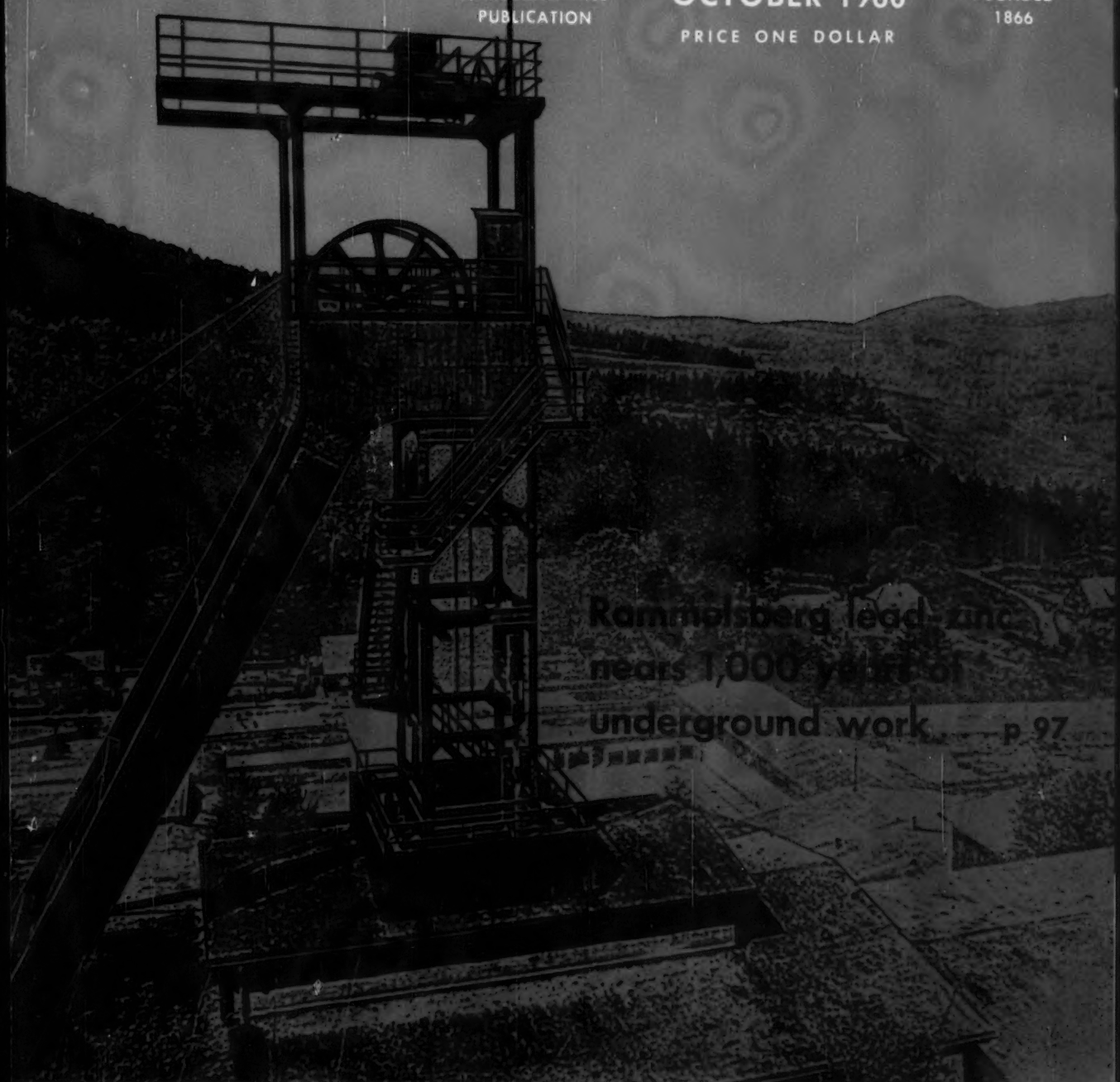

Rammelsberg lead-zinc nears 1,000 years of underground work . . . p 97

St. Lawrence River Mines plans an open pit for columbium . . . p 92
Air classifier for phosphate . . p 105
Submarine gold mining . . . . p 108
Plasma metallurgy — a promising technique is developing . . . p 112

INTERCHANGEABLE SLURRY PUMPS

for 400 to 8 mesh

1½" to 14"

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ALL PARTS IDENTICAL EXCEPT: IMPELLERS AND ENGINE-SIDE SHELL HALF-LINERS

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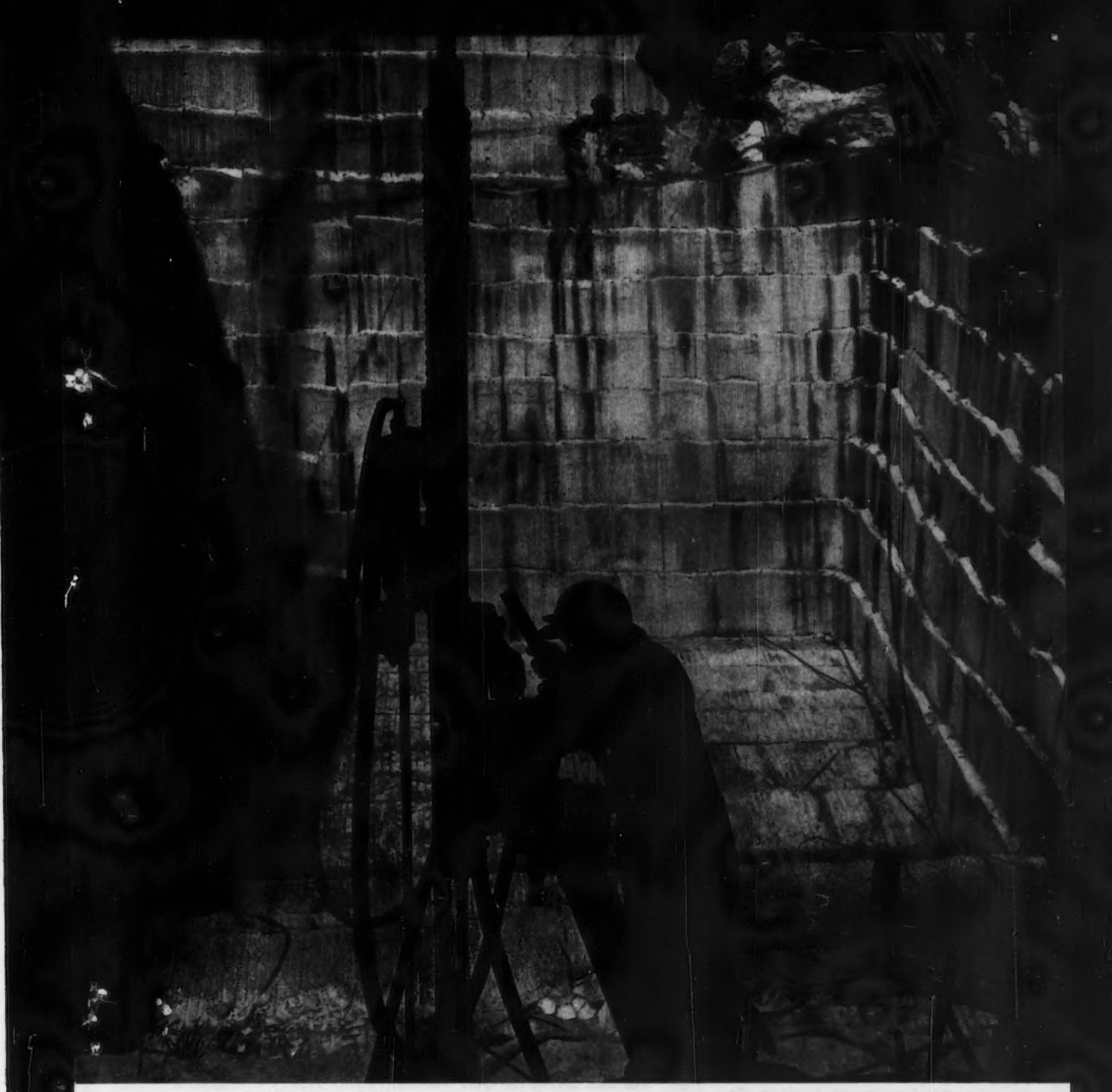

Drill Steel Bores Deep in Alabama Marble. You're looking at one of the quarries of Moretti-Harrah Marble Company, Sylacauga, Ala., where blocks of gleaming white marble are wrenched from the earth's grasp by means of broaching and drilling. In the areas where blasting is necessary, the holes are drilled as deep as 14 ft, many of them with round or hexagon Bethlehem Hollow Drill Steel. Bethlehem Hollow is the kind of drill steel that operators can always count on for reliable performance. It's a quality steel, through and through. It's available in Carbon and Ultra-Alloy grades . . . in rounds, hexagons and quarter-octagons.

Bethlehem Steel Company, Bethlehem, Pa. *Export Distributor:* Bethlehem Steel Export Corporation

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Mining Calendar

American Mining Congress, annual meeting, Las Vegas, Nev., Oct. 10-13
Symposium on Surface Mining Practices. University of Arizona College of Mines, Tucson, Oct. 17-18
Tenth Annual Symposium on Production Drilling & Blasting, Colorado School of Mines (Prof. L. J. Parkinson), Golden, Oct. 17-19
Metallurgical Society, fall meeting, Sheraton Hotel, Philadelphia, Oct. 17-21
48th National Safety Congress, National Safety Council, Chicago, Ill. Oct. 17-21
New Mexico Mining Assn.-Southwest International Mining Assn. annual meeting, La Fonda Hotel, Santa Fe, Nov. 3-5
Electric Furnace Conference, Morrison Hotel, Chicago, Nov. 30-Dec. 2
National Conference on Water Pollution, Public Health Service, Washington, D.C. Dec. 12-14
Light Metal Industry Symposium, National Metallurgical Laboratory, Jamshedpur, India, February 1961
AIME annual meeting, Chase-Park Plaza and Ambassador Hotels, St. Louis, Feb. 26-March 2
International Symposium on Agglomeration, Philadelphia, April 12-14, 1961

Coming Up

From Las Vegas—Post-show coverage of the American Mining Congress Show being held this month in Nevada. Some of the biggest and hottest mining equipment in years will be displayed (and reported in these pages), as will the new techniques and industry developments which dominate the sessions and panels. It's an election year, and Government officials will be attending AMC in force: their sayings and doings will be reported in a special on-the-spot report in our regular Washington Impact columns.

From the Southwest—"The first commercial plant in the United States using the segregation process for treating oxidized and mixed oxide-sulphide copper ores has been placed in operation." The story of an old concept which is now reaching fruition will be told next month, with flowsheet and full description of the property and process.

From the Southeast—Roof control as she should be did. A detailed report of the excellent and thorough work done by St. Joseph Lead Co., which resulted in successful use of concrete pillars for roof control.

94th YEAR OF PUBLICATION

ENGINEERING AND MINING JOURNAL

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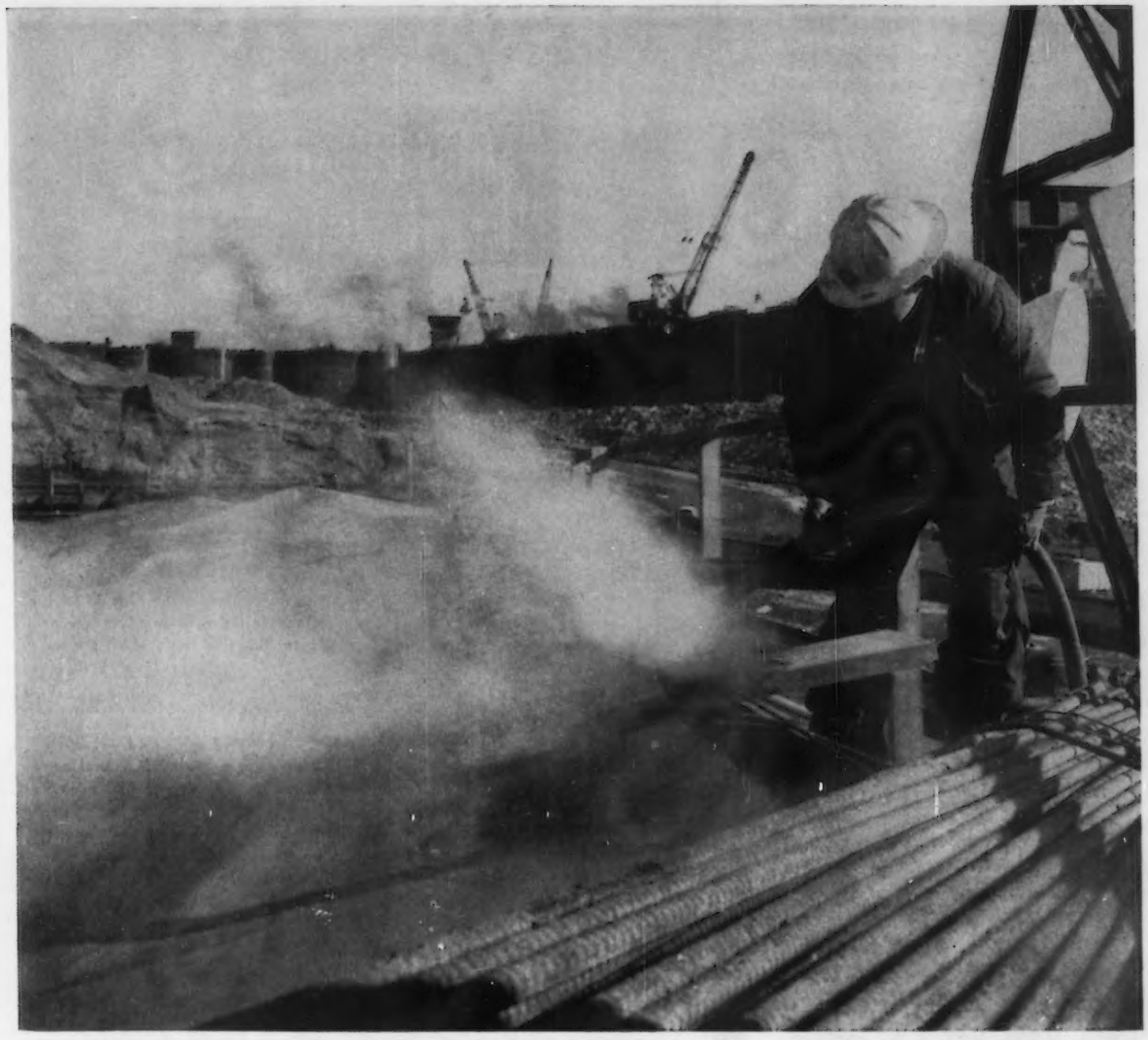

B.F.Goodrich takes the sting out of steam hose

Makes steam-handling safe with a hose that can't explode

THE job this man's doing used to be plenty dangerous. He's using scalding steam to cure concrete locks on a big construction project in southern Ohio. Heat used to weaken steam hose. Sometimes it burst with explosive force, spraying scalding steam, seriously injuring workmen.

To make a hose that would be safe, B.F.Goodrich engineers developed a new kind of heat-resistant rubber which they used inside the hose and between plies. Then they built layers of fine braided wire for reinforcement right into the hose.

The result is an improved hose—called Burstproof—that makes steam-handling safe. Even when this hose finally wears out after years of service, the steam will leak out, but the hose won't explode!

Engineers at the Captain Anthony Meldahl Locks and Dam project, Chilo, Ohio, report "no breakdown whatsoever" with the 3000 feet of Burstproof steam hose they're using. This despite fairly constant use, heat and pressure, and the abuse it takes as it's dragged over sharp concrete and rough, rocky ground.

Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich steam hose described here. And, as a factory-trained specialist in rubber products, he can answer your questions about the many products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Company, Dept. M-920, Akron 18, Ohio.*

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Articles in this issue of

ENGINEERING AND MINING JOURNAL

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91 Gold Subsidy Proposal to Halt Dwindling Reserves
With the increase of concern over the decline of the U.S. gold reserve, the time may be right for the domestic gold mining industry to request and get a government subsidy. However, such a program must be justified to Congress. E&MJ offers a three-point argument on why Congress should grant a gold subsidy and who should get it.

92 Tapping a New Columbium Deposit in Quebec
St. Lawrence Columbium and Metals Corp. of Montreal is proceeding toward the operation of a 550-ft-deep open pit mine in the Oka District, in expectation of a growth of demand in the next five to twenty years, as predicted by industry observers. A pilot plant flotation study which showed the way is illustrated in a flowsheet.

97 Rammelsberg Mines—1,000 Years of Mining
If the first 1,000 years are the hardest, Rammelsberg has made it and can still count on 30 more years of profitable mining. By using several mining methods and treating different grades of ore in separate plants, low-grade, complex ores are successfully worked. Metals recovered from the deposit include lead, copper, zinc, iron, barite, gold, and silver. The complex ores also contain antimony, cadmium, bismuth, and indium.

105 Air Classifiers Reclaim Phosphate
Two new air classifiers to separate fines from phosphate rock have three important advantages to a Florida processing plant. Since the installation of these classifiers, more than 95% of phosphates formerly lost have been reclaimed. Result: enough increase in profit to pay for the unit in less than a year.

106 Safe Ore Extraction from Remote Control Loader
To cut costs of loading broken ore during the retreat phase of mining, with no decrease in safety, and still get nearly complete extraction, the Marquez Mine, Uranium Div. of Calumet & Hecla Inc., came up with a remote-controlled loading machine. The development proved itself by recovering otherwise lost ore and making bulk blasting possible.

108 There's Gold in Them Waters
The streams of central and northern California are now hatching frogmen intent on underwater gold prospecting. Although the technique is still a hobby for most of the skindivers, mining men may take serious interest in the equipment developed here for exploring other deposits in stream beds, lake bottoms, or elsewhere under water.

112 Plasma Technology Continues To Develop
Ultra-hot plasmas may ultimately point the way to new techniques for the extractive metallurgist if research on a flame jet method is successful. Here are some of the developments completed so far and a theory on an application of this new technology.

36 Years...handling ore, waste, timber, supplies

This may not be the oldest Little Trammer in daily service, but it certainly has been one of the most versatile. For 36 years, it has been used all over a Southwest metal mine . . . underground . . . handling ore, waste, timber and supplies. Temperatures have been as high as 125° with humidity at 90%.

Today's Work Horse . . . *tougher and more dependable than ever*

. . . the reason! A consistent program of product improvement. Now the Little Trammer has glass-wound armatures and field coils which increase ability to withstand high ambient temperatures, heavy continuous service and the use of larger batteries with safety. Lever brake can be quickly and easily applied and has a positive release. Camtactor controller provides trouble-free service. Heavy duty springloaded plugs and receptacles have locking latch handle. Finally, the motorman is protected by a rugged shield.

Mancha's Little Trammers are small enough for narrow drifts, are never slowed down by climate, altitude or poor ventilation. They have a record of paying for themselves in a short time . . . they'll do the same for you. Ask for the full story. No obligation.

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Mancha representatives are located in principal mining areas throughout the world.

94 YEARS OF MINING

The following news items are reprinted substantially as they first appeared in the AMERICAN JOURNAL OF MINING, the publication which became *E&MJ*.

CALIFORNIA, JUNE 1866 — The REGISTER says: The company owning the borax mines have made extensive preparations for taking out large quantities of borax this season. Thirty teams will soon be running . . . making weekly trips of a ton to a load.

PENNSYLVANIA, JUNE 1866—The Oil City REGISTER has this item: A new well was struck Saturday morning, May 5th on Hickory Farm. It is 223 feet deep and through the second sand-rock, throwing out an oil of 45 gravity to the handsome amount of 200 barrels per day.

NEW JERSEY, 1866—An iron mine opened last fall, near the village of Bethlehem, was worked steadily all the winter with a small number of hands. An average of ten tons per day was taken out. The mine is an extensive one and the ore has been pronounced, by competent judges, to be of superior quality.

UTAH, JUNE 1866—The VEDETTE says: The result of 15 assays by Mr. Harzline, of Eagle canon, from the croppings of the Emet ledge, gave all the way from $50 to $250 in silver, and $9 to $23 in gold, per ton.

ARIZONA, JUNE 1866—The MINER reports the following: Mr. Wickenburg is doing well with his mill at the Vulture; the Curtin mill, owned by Jack Swilling, is for sale as Mr. Swilling is absorbed in the proposed expedition to the Chiracahua mountains; General McDowell's party, on leaving Tucson, took with them a quantity of silver extracted in a rude way from the mines.

BRITISH COLUMBIA, 1866—New diggings have been struck on Clemens creek (Big Bend region) and nine dollars to the pan taken out. The snow is too soft on the mountains yet for packing with animals, and Indians are hard to get to pack freight at sixty cents per pound.

This month in

ENGINEERING AND MINING JOURNAL

Continued from p4

Behind the By-Lines

We haven't done any political reporting since the old days around the County Court House, but, since this is the last time you'll be seeing this page until after election we thought we'd take a small sideswipe at it.

What got us thinking along political lines was a triple coincidence:

1) the boss's editorial this month speaks again of the U.S. gold situation and offers E&MJ's suggestion for a part solution to the low estate of domestic gold mining;

2) the NEW YORK TIMES of Sept. 23 noted that in the previous week U.S. monetary gold stocks dropped $181-million, "the largest in a normal week in nearly 30 years";

3) both candidates for the Presidency, in the celebrated first "Kennedy-Nixon Debate" late last month, agreed to a principle that we firmly believe applies to the problem.

The editorial speaks for itself; see p 91. Unfortunately, the drop in gold stocks also speaks for itself.

The agreement in principle was stated, not in regard to mining, but to the farmer. Both candidates offered their versions of the kind of farm support programs needed for the future. And, when asked why the farmer deserved such financial help from the government, Vice President Nixon said, ". . . the Government has a responsibility to get the farmer out of the trouble he presently is in because the Government got him into it."

"The farmer produces (the) surpluses," Mr. Nixon said, "because the Government asked him to through legislation through the war.

"Now that we have these surpluses, it's our responsibility to indemnify the farmer during that period that we get rid of the surpluses."

Well, sir, we were suddenly reminded of some people we knew who were in trouble because the Government got 'em into it.—Or, to more properly identify the gold miners who were closed by L208, "because the Government got 'em out of it." The closure of the domestic gold mines, and the hardship wrought by the action, certainly comes under the heading of "trouble," and, while the idea of a subsidy for domestic gold production may not be the best answer, we sincerely suggest it as one move which is perhaps capable of Congressional and Executive approval, and commend it to the attention of the upcoming Congressional investigation into the domestic gold situation. (See p 28.)

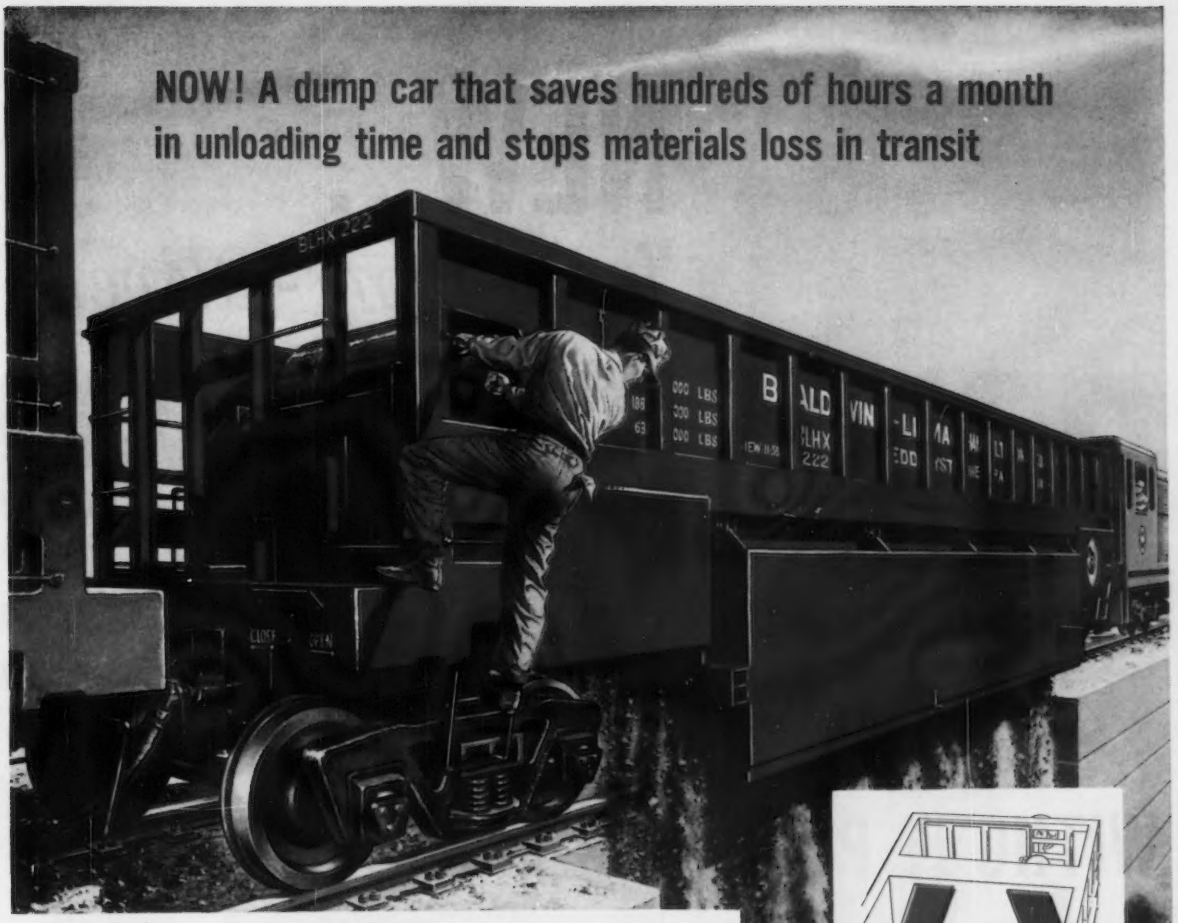
Our own candidate for Gallant Individual (Distaff Division—Rustic Section) remains Mrs. George Wolfe, of Lewiston, Idaho, who has won another round in her long battle with the U.S. Forest Service.

Mrs. Wolfe, you remember, is the lady who packed up her seven children and moved to a cabin on a 20-acre gold claim in the Salmon River country to give the kids a better education than she thought they were getting in school and to work the claim.

She held off the Forest Service successfully when they failed to prove that her family "would substantially interfere with recreational and forest protection activities" in the area.

School authorities attempted to have the children returned to the classroom, so Mrs. Wolfe is now attending teachers' college to get official sanction for her own "school." She'll do it, too.

NOW! A dump car that saves hundreds of hours a month in unloading time and stops materials loss in transit

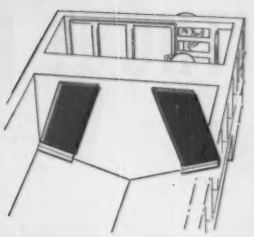


Designed to dump straight down into a receiving bin or hopper, B-L-H's new and highly efficient bottom dump gondola virtually does away with the two bugaboos that have long plagued copper-concentrate producers and other processors of ore and chemicals—time-consuming unloading operations; and ore losses in transit.

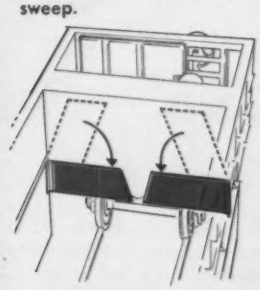
Note these major features of the car:

- Sides slope slightly outward at the bottom, to overcome any tendency of the materials to stick to the walls
- Special low-adherence paint further counteracts sticking
- Steel blade device extends up into body of car, acts as scraper along endplates; blade device is optional—need for it depending on characteristics of material to be dumped
- One movement of a single lever dumps payload clean and fast
- Rubber seals fastened to inside of door plates and running along three sides of each door prevent liquids from leaking out

B-L-H's new ore-carrying dump car can be built to your individual specifications in any capacity you require. For complete details, write requesting Bulletin 3001.



In dumping, as doors swing down and out, knife blades welded to doors cleave mineral deposits from ends of car in one fast, clean sweep.



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NEW...

from Dorr-Oliver

THE D-O

High-capacity hydraulic cleaning and two-product classification in 20-325 mesh-range...

WITHOUT POWER OR MOVING PARTS!

Water is all that is necessary to effect efficient 2-part classification in the new D-O SiphonSizer. No moving parts or power is involved—resulting in low first cost and maintenance expense.

Essentially, the D-O SiphonSizer is a simplified hindered settling classifier featuring automatic control and discharge. Water for classification is distributed uniformly and under pressure through nylon jets located at the bottom of the tank. Two-part separation is accomplished as the coarse material settles against the rising current of water while the fine fraction is washed upward to the overflow launder.

The heavy or coarse fraction becomes, in part, a teetered bed which is continually being washed and stripped of its fine material. At a predetermined point, siphons automatically remove the coarse material to keep the fluid bed in equilibrium. Classification efficiency remains high even during large fluctuations in feed rates. The SiphonSizer can even be shut down and restarted under full load. The only stipulation is that hydraulic water remain on until incoming feed has ceased.

The D-O SiphonSizer is offered in 3, 8, 12, 14, 16, and 18 ft. diameters. Capacity depends on feed characteristics and desired mesh of separation. For more information on this newest classification tool, write for a copy of Bulletin No. 2350 to: Dorr-Oliver Incorporated, Stamford, Connecticut.

SIPHONSIZER

Cutaway drawing above demonstrates features and principles of operation. Feed enters through baffled feedwell. Water, introduced through hydraulic water manifold, washes out and overflows fine material into overflow launder. Coarse fraction becomes a teetered bed constantly being washed by upward moving water. When teetered bed builds up to a predetermined point, coarse discharge siphon, controlled by siphon control float valve, automatically removes coarse material at a desired rate to keep bed in equilibrium.

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The New Earth-Mover

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As you know, today's earth-movers move bigger loads faster than ever before.

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With Goodyear Earth-Mover Rims you enjoy such additional benefits as a heavy-duty bead seat band driver – to prevent slipping under severest operating conditions. And you get the positive air seal provided by Goodyear's famous Tru-Seal principle.

Goodyear makes rims in widths up to 37" and diameters up to 49". To prevent premature tire and rim failure, it pays to buy and specify rims job-fitted by Goodyear. See your local rim distributor, or write: Goodyear, Metal Products Division, Akron 16, Ohio.

Send for Free Goodyear Rim Catalog

–84 pages of facts and pictures on Goodyear's complete line of rims for every type of vehicle.

Tru-Seal–T. M. The Godyear Tire & Rubber Company, Akron, Ohio

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Only Goodyear Rims
have *Bond-A-Coat Finish,*
for lasting protection
against rust and corrosion.

Buy and Specify RIMS by

GOODYEAR

MORE TONS ARE CARRIED ON GOODYEAR RIMS THAN ON ANY OTHER KIND

engine power
BY CATERPILLAR

BIG NEWS FOR SMALL-MINE OPERATORS

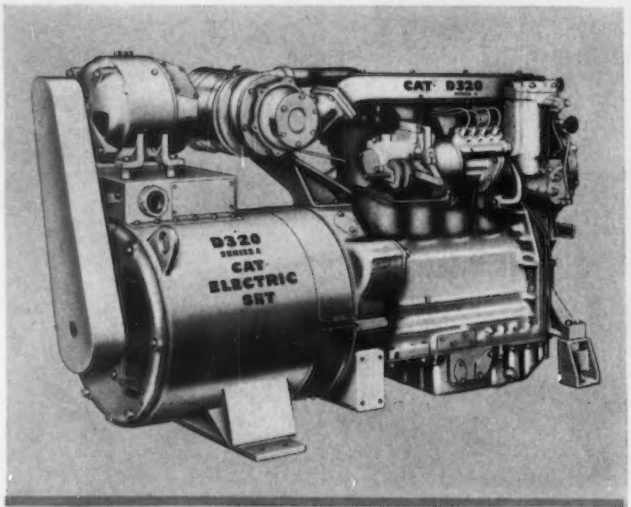
A new Cat 40 KW Electric Set that's lighter, more compact and comes with AC or DC generator

This new Cat D320A Diesel Electric Set weighs less, is smaller than its predecessor and generates 40 KW at 1800 RPM. Its unexcelled heavy motor starting ability starts normal current induction motors up to 30 HP.

The built-in voltage regulator on the D320 is completely automatic. Because it's self-regulating, there's no need for an external control panel.

Where the fuel tank must be located below the engine, the gear type transfer pump on the new D320 provides 12 feet of lift to overcome terrain problems. Like all Cat Engines, the D320 burns low-grade fuels and gives top efficiency.

Now small-mine operators can get a more maneuverable Caterpillar Electric Set to power cutting machines, diggers, a small loader or electric locomotive, ventilation equipment, lighting and battery-charging equipment. In larger mines, larger Cat Electric Sets (AC or DC) are available to supply nearly all power requirements. Why not ask your nearby Caterpillar Dealer for a demonstration today?

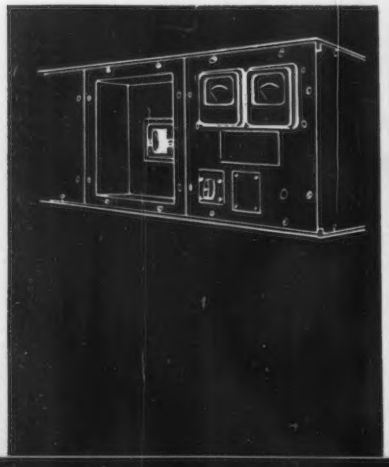


CATERPILLAR

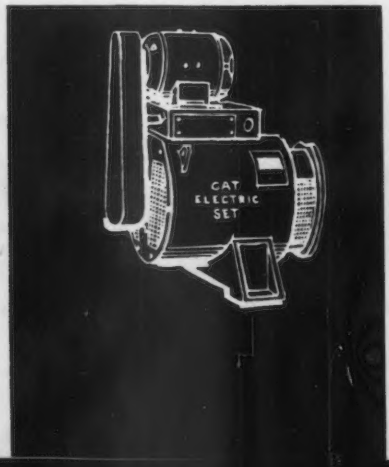
Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

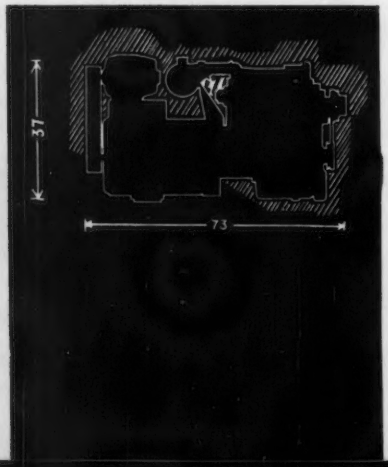
This new Cat Diesel Electric Set does not require an expensive external control panel.



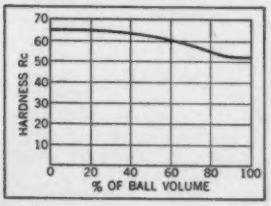
Output terminals are at top of generator frame for accessibility and protection from grease and water.



The new, compact Cat D320A is scaled to fit all types of applications in the small mine.



Immediate delivery on USS Grinding Balls We swing into action immediately when you order USS Grinding Balls. Thus, they are delivered to you when you need them. We can ship promptly from stock that includes a complete range of sizes from ¾″ to 4″ in USS Carbon-Manganese Steel and USS Alloy Steel. Here are three reasons why USS Grinding Balls are your best buy: **Maximum hardness** combined with superior toughness. **Deeper hardness penetration** achieved by careful combination of heat treatment and composition. **Uniform roundness** from ball to ball, load to load, for less wear and superior performance. If you have a delivery, performance, or selection problem, call our nearest Sales Office or United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.



USS is a registered trademark

This mark tells you a product is made of modern Steel

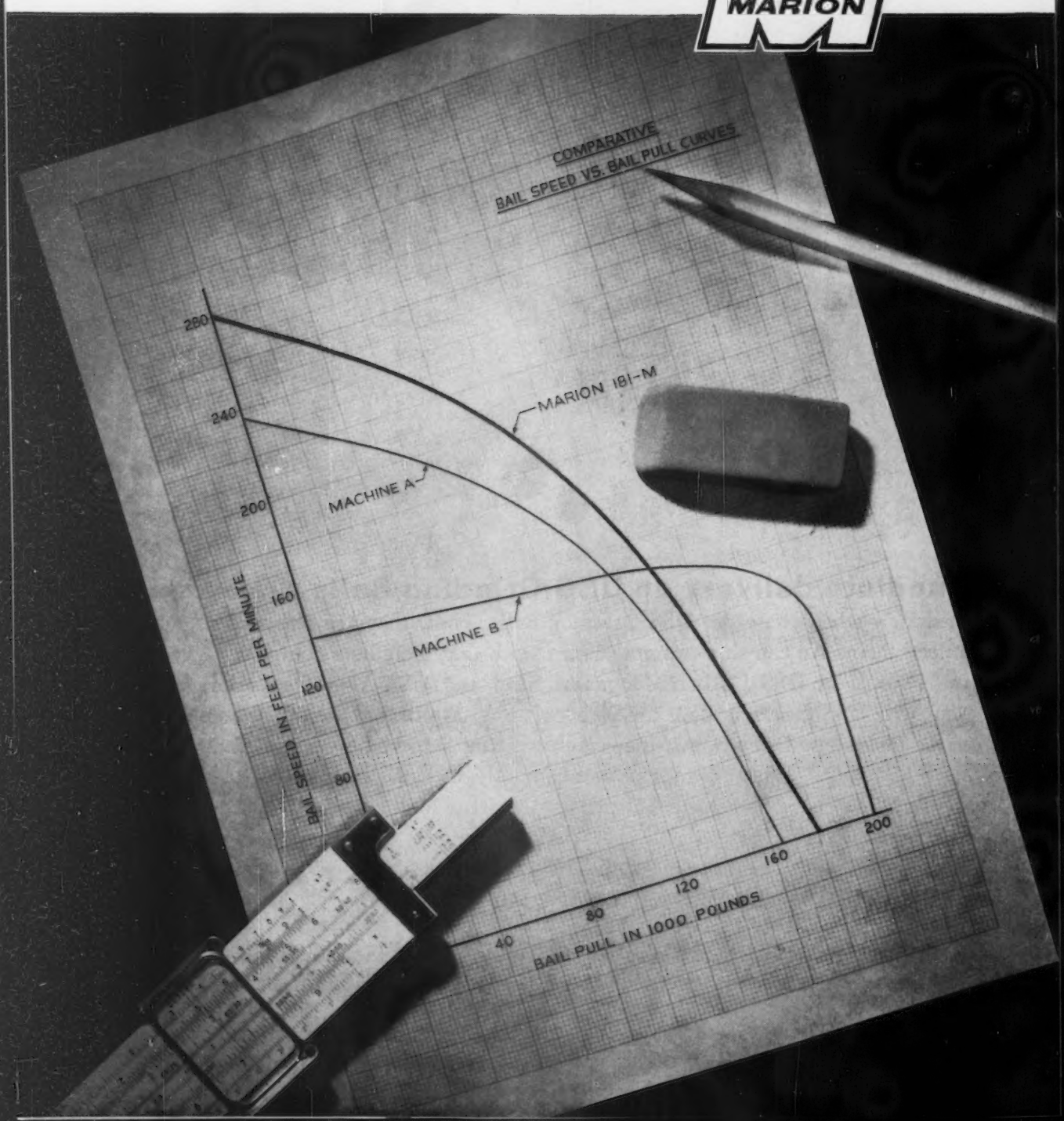
United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Export Company
United States Steel

USS

THIS IS MARION QUALITY

No question about it. You can have too much of a good thing. Take high bail pull on an excavator, for example. It means nothing until combined with speed. A practical amount of power is necessary... the amount Marion's variable voltage drives gives you to properly balance digging force AND speed to match the bank conditions. And, Marions have the machine weight to back up their power output and give long life. Wasted power is almost negligible since the operator can control the output to the requirement precisely—within the range of a few horsepower. If you'd like to have more bail pull than you'll ever need, we can (like other manufacturers) give it to you, plenty of it. But, at the expense of operating speeds, possible coil burnouts, clutch member seizure and high power loss in heat instead of useful work. Depends on what you want. We're betting on economy of operation and we think excavator owners are doing the same. Marion Power Shovel Company, Marion, Ohio. A Division of Universal Marion Corporation.

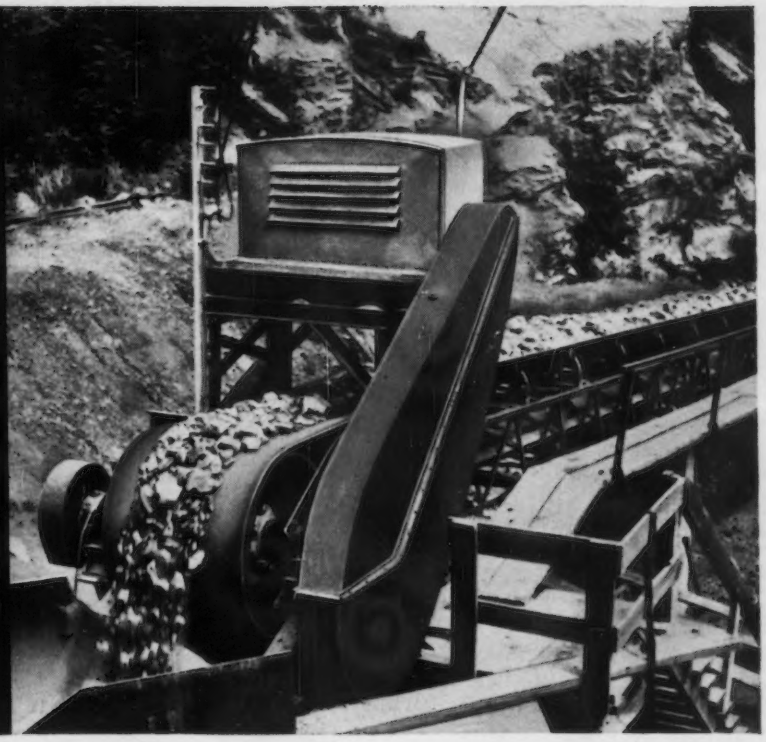
MARION



GOODYEAR

Now...
to remake belting
history..

NEW
INDUSTRIAL
UNIFLO



...the conveyor belting built for the belt-killers

This is it! New Industrial UNIFLO is the *first* woven-carcass rubber belting specifically designed to make history in hard-rock mining, quarrying, steel mills, pulp mills, foundries and the like.

New Industrial UNIFLO construction is available in a variety of compounds and gauges—including heat- and oil-resistant types. And extensive tests—underground and above-ground alike—have proved its superior capabilities under the toughest operating conditions.

To be specific, UNIFLO construction has . . .

. . . **proved** its unparalleled resistance to internal rupture caused by trapped material or pulley build-up

. . . **proved** its tear-resistance 3 times as great as comparable synthetic fabric-reinforced belts—10 times as great as comparable cotton-reinforced belts

. . . **proved** its excellent impact-resistance

. . . **proved** its unusually fine cover adhesion and cut-resistance

. . . **proved** its outstanding troughability and trainability

. . . **proved** its exceptional edgewear resistance

. . . **proved** its top-rank fastener-retention—handling wet or dry materials

But these are only the highlights of the great new Industrial UNIFLO Belting. For complete details, check with the G.T.M. — Goodyear Technical Man — through your Goodyear Distributor. Or write Goodyear, Industrial Products Division, Akron 16, Ohio.

GOODYEAR INDUSTRIAL PRODUCTS

GTM-Specified

Industrial UNIFLO conveyor belting for severe above-ground service

A Seamless, tough covers in a full range of compounds and thicknesses for superior protection against cuts, abrasion, heat and oil

B Single unit carcass of high-tensile, interwoven yarn bonded to the cover under high pressure to give you exceptional strength and fastener-holding qualities — good troughability and trainability

Lots of good things
come from

GOODYEAR

INDUSTRIAL PRODUCTS

Uniflo-T.M., The Goodyear Tire & Rubber Company, Akron, Ohio

PROOF (from Anaconda)

that a Ni-Hard Mill Liner is good to the last ¼ inch

You've heard it said many times..."A Ni-Hard Mill Liner is good to the last ¼-inch!"

Well here's photographic proof; from the Montana mines of The Anaconda Company, where the long life and outstanding performance of Ni-Hard* nickel-chromium-iron alloy liners have saved many thousands of hours of downtime. And done wonders for tonnage too — in both ball mills and rod mills, at the feed end as well as the discharge end.

This "good-to-the-last-¼-inch" performance of Ni-Hard mill liners can do wonders for your tonnage. For if ever there was a service where superior abrasion-resistance coupled with a uniform wear-rate really counts, it's in mill liners. Try a set of Ni-Hard liners in your mills and see for yourself.

Ni-Hard iron's superior abrasion-resistance and uniform wear-rate also count heavily in prolonging the life of feed spouts, pipe elbows, slurry pump liners and impellers, dust-collector cyclones, chute liners and many other parts for ore-processing equipment.

Our detailed, 58-page booklet, "Engineering Properties and Applications of Ni-Hard" suggests many ways to put versatile, long-wearing Ni-Hard to work profitably. Say the word and we'll be glad to send you a copy.

*Registered trademark

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street INCO New York 5, N. Y.

NI-HARD®

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

ONLY ALLIS-CHALMERS MOTOR SCRAPERS

give you

FULL POWER

... in every phase of the cycle

FULL POWER TRACTION
FULL POWER PENETRATION
FULL POWER EJECTION
FULL POWER STEERING

Steady production... even in mud

Fast, controlled loading

Quick, controlled loading

Safe, positive turning

FULL POWER STEERING

Only Allis-Chalmers gives you this exclusive combination . . . a separate hydraulic system just for steering, exclusive multiplier links, and double-acting steering jacks.

These are the big reasons why Allis-Chalmers motor scrapers give you more sharp-turn, easy-maneuvering ability than *any ordinary units.*

A separate hydraulic steering system assures positive power for best performance during simultaneous steering and scraper operations. And Allis-Chalmers exclusive multiplier links give you a big edge over any other type of steering device. Double-acting jacks *push* and *pull* for faster turn-recoveries.

Watch the TS-360, for example, excel any comparable-sized unit in turn-ability on *your* job. Let your Allis-Chalmers dealer show you the "standing still" 180° pivot. You'll see how Allis-Chalmers *full-power steering* easily overcomes maximum turning resistance.

ALLIS-CHALMERS ALL-HYDRAULIC MOTOR SCRAPERS

Safe, positive turning

FULL POWER EJECTION

Only Allis-Chalmers all-hydraulic motor scrapers give you two-stage hydraulic ejection teamed up with the highest apron opening in the business.

The new hydraulic 340-hp TS-360 gives you a *full 10-ft. opening* from cutting edge to apron at full raise . . . higher than any other unit. With *double-barreled hydraulic power* the *360's* twin telescoping cylinders spread heaped loads without interference . . . without slowing down the cycle. Let your Allis-Chalmers dealer show you *any* Allis-Chalmers motor scraper working side by side with any other unit of *your choice.*

Bring your stopwatch, prove to yourself that Allis-Chalmers *full power ejection* is unequaled for fast, smooth spreading.

ALLIS-CHALMERS ALL-HYDRAULIC MOTOR SCRAPERS

Smooth, even spreading

10 to 30 yds heaped...155 to

FULL POWER PENETRATION

Only Allis-Chalmers all-hydraulic motor scrapers give you double-acting bowl jacks that penetrate for faster loading, controlled digging.

Exclusive hydraulic down pressure on the cutting edge permits quick penetration into the toughest-loading materials. Penetrating force like this—along with Allis-Chalmers' original low, wide bowl—gives you fast, heaped loads every pass. Operators go for this precision bowl control in a big way. You will too, when you see the results.

For definite proof, compare Allis-Chalmers performance with any other motor scrapers—in any cut . . . regardless of material.

ALLIS-CHALMERS ALL-HYDRAULIC MOTOR SCRAPERS

Fast, controlled loading

Quick, controlled loading

Safe, positive turning

horsepower...

TS 160 TS 260 TS 360

FULL POWER TRACTION

KON-TORK differential provides every Allis-Chalmers motor scraper with full-time traction magic. You get all-weather production to help meet tight schedules.

KON-TORK differential works automatically. In the cut, on the haul or soft fill, it helps boost cycle time by automatically controlling the transfer of torque to each drive wheel... giving you full benefit of *maximum tractive effort all the time.* Another nice thing about KON-TORK differential is that it's simple. Its five moving parts require no adjustment.

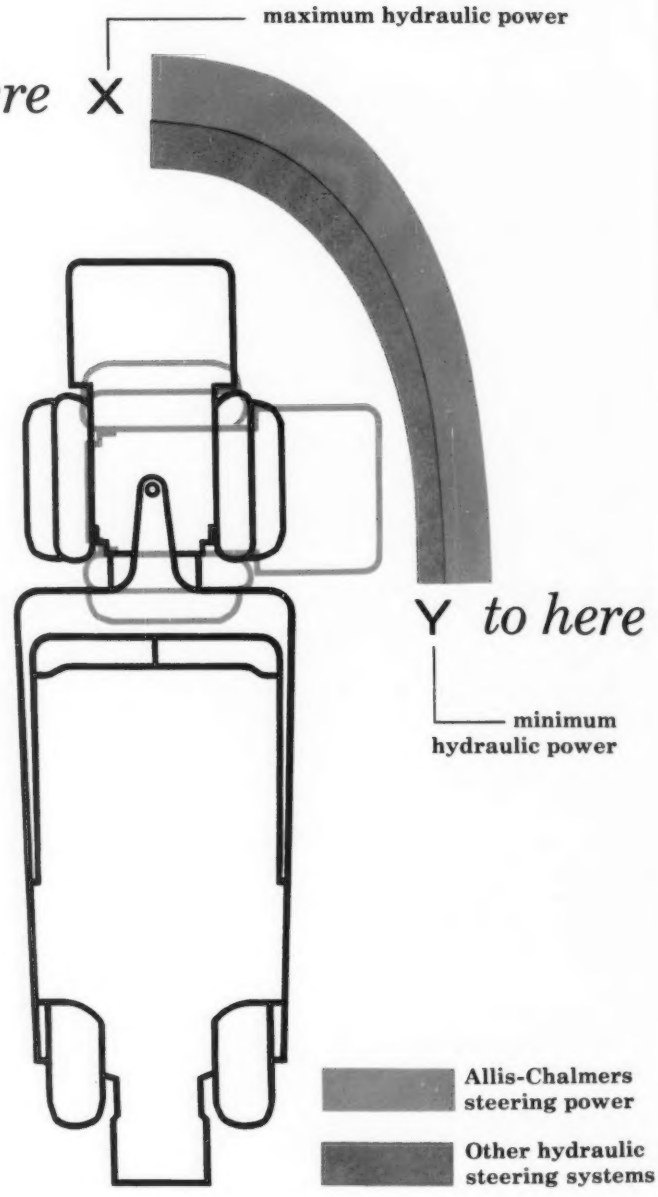
ALLIS-CHALMERS ALL-HYDRAULIC MOTOR SCRAPERS

Steady production...even in mud

Only Allis-Chalmers all-hydraulic motor scrapers give you

FULL POWER STEERING

from here X



HERE'S HOW

1 **Fast, 180-degree, non-stop turning** in less than machine length with only one-sixth turn of the steering wheel.

2 **Faster recoveries** from full 90-degree turns than any other motor scrapers.

3 **Double-acting hydraulic response** to match any situation in every phase of the cycle.

Only Allis-Chalmers motor scrapers can provide you with these exclusive advantages.

As illustrated in the graph, Allis-Chalmers hydraulics provide more turning power at point *Y—the low power point in any steering system*—than most other motor scrapers have at point *X, the point of maximum hydraulic turning effort.* The reasons: Allis-Chalmers motor scrapers provide independently powered hydraulic steering systems. And Allis-Chalmers advanced engineering has resulted in a hydraulic system which is the standard of the industry.

155 to 340 horsepower.....

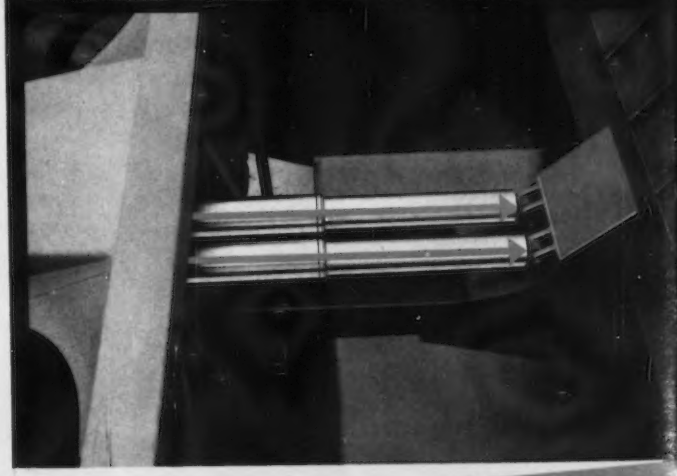
10 to 30 yards heaped.....

all hydraulic.....

Here's how full-power penetration puts enough force on the cutting edge to pivot this load clear of the ground. Only through the outstanding durability which is built into every Allis-Chalmers *seal, hose, jack, valve* and *pump* . . . can superior loading performance be realized day after day. The story is one of precision engineering and machining . . . quality materials . . . constant testing . . . and never-ending hydraulic research.

Here's how KON-TORK differential works for you every minute of the day. Whether you're loading, hauling, or spreading . . . you *always benefit* from the traction boost of KON-TORK differential. As footing conditions vary, tractive requirements are met automatically through KON-TORK differential's smooth transfer of power from wheel to wheel.

KON-TORK differential's simple, rugged design utilizes only five moving parts which require no adjustment. Try full-power traction on your job soon. You'll quickly see its big benefit—building up fast on the fill.



Here's how full-power ejection assures speedier fill work. Telescoping *hydraulic* rams provide *two-stage* ejection power. The first—and most powerful—stage forces the whole load forward. The second faster stage kicks out the remainder of the load clean as a whistle. It's no wonder Allis-Chalmers motor scrapers give you fast, even lifts every pass with *full-power ejection* . . . with *up to 2 ft. more apron lift* than any comparable-sized units.

Quick, controlled loading

Safe, positive turning

You can't afford to pass up FULL POWER EARTH-MOVING PERFORMANCE

Pick a date for a demonstration now... with the all-hydraulic machine that fits your needs best!

TS 360

340-HP 22.3 TO 30 YD

TS 260

230-HP 13.5 TO 18 YD

TS 160

155-HP 7.5 TO 10 YD

Allis-Chalmers motor scrapers have proved their capabilities on thousands of jobs ranging from superhighways to simple, single-unit stripping jobs. You owe it to your investment and your future to appraise the industry's only *full-power* motor scraper line.

Only *performance* puts profit in your pocket . . . look beyond the paint when choosing your next modern earth mover. Your Allis-Chalmers dealer will be out to demonstrate on your job . . . can help finance your equipment . . . will back you up with service that satisfies.

ALLIS-CHALMERS CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

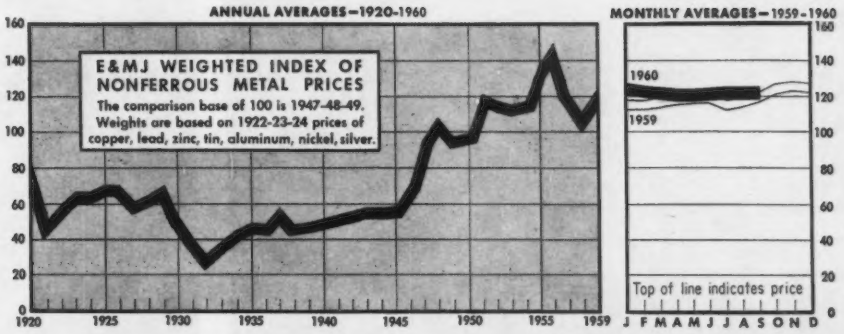
move ahead with ALLIS-CHALMERS
...power for a growing world

KON-TORK is an Allis-Chalmers trademark.

LITHO IN USA D&L

E&MJ OUTLOOK

PRICES



MARKETS

E&MJ's September price index was 126.0, unchanged from the weighted average recorded in August. All nonferrous metal prices were unchanged except tin which was down .7c.

•

AT HOME

Texas Gulf Sulphur Co. core drillings on potash reserves at Cane Creek in southeastern Utah "fully confirm a very large deposit believed to be richer than any other known to exist in the U.S.," announced the firm's president, Claude O. Stephens. On the basis of the new find, Texas Gulf plans to invest $20- to $30-million to construct potash facilities in the area.

The AEC has extended into 1966 its concentrates buying contract from Climax Uranium Co.'s Grand Junction, Colo., mill. The agreement runs from Aug. 1, 1960 to Dec. 31, 1966, but Climax can complete the commitment at any time before the cut-off date. This extension was the first for a Uravan mineral belt mill.

Wyoming Mining Assn. representatives have proposed to state officials 27 changes to Wyoming's mineral leasing policies on state-owned land. Included in the recommendations were provision for oil shale prospecting permits and leases, granting preferential rights for renewal of leases, and a suggested minimum royalty to be paid to the state by companies holding state land in reserve.

Stauffer Chemical Co. has announced plans to start construction early in October on its $20-million trona development near Green River, Wyo. Work will begin on a shop and warehouse. The company has not said when shaft sinking or railroad construction would be under way.

Financial observers say that concern over the continued decrease in U.S. gold reserves is premature—it's confidence in the dollar that counts. At a joint meeting of the International Bank for Reconstruction and Development, International Monetary Fund, and International Finance Corp. in Washington, September 28, Treasury Sec. Robert B. Anderson said that the U.S. aims for "policies which will maintain the dollar at its existing gold parity as a sound and reliable currency." (See p 91.)

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LABOR

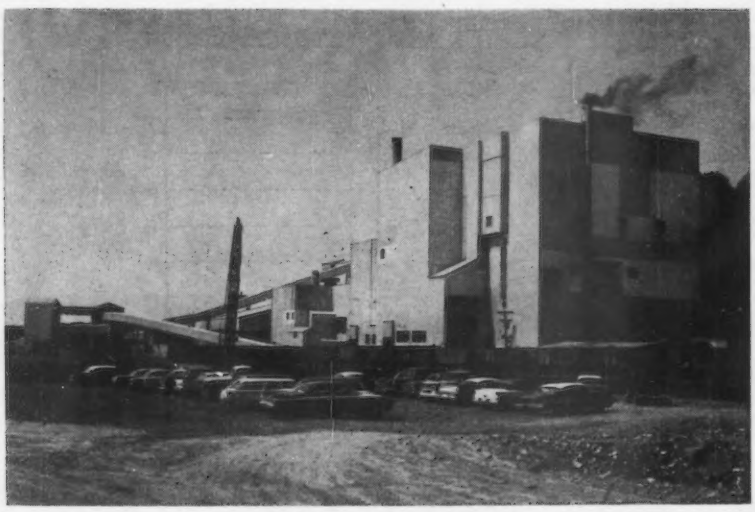
The zinc industry now has 17,200 tpm capacity out of production due to labor disputes involving strikes. Bunker Hill Co., New Jersey Zinc, Matthiessen & Hegeler Zinc Co., and a small portion of Asarco are struck.

•

ABROAD

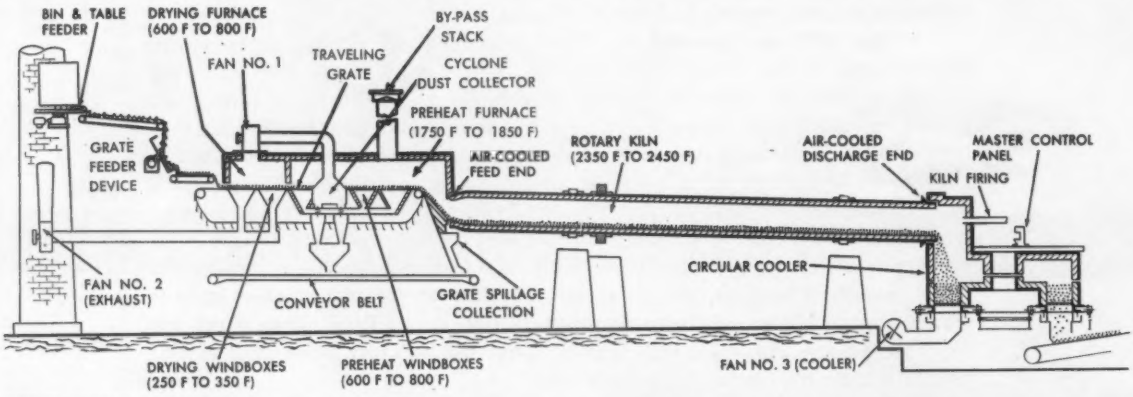
Ghana has called for bids on initial development of the country's Volta River hydro-electric project at Akosombo (E&MJ, June 1960, p 22). The government will invest about $84-million in a $180-million program intended to provide electric power for aluminum production in the area.

Two Northern Rhodesian copper groups are considering production cuts because of falling copper prices. A spokesman for the firms, Anglo-American and the Rhodesian Selection Trust, said that the over-supply position "demands the most careful consideration not only by Rhodesian producers, but by producers all over the world."



MODERN LAYOUT of the $15-million Humboldt operation includes the crusher buildings (background), flotation buildings in the center and agglomeration in the foreground. Low grade ore (30% Fe) is upgraded to the plus-62% range in the plant.

THE STARTING BUTTON is pushed by Irving A. Duffy, Ford Motor Co., and Walter A. Sterling, Cleveland-Cliffs.



MINE OFFICIALS credit the flotation process and the Allis-Chalmers Grate-Kiln process for economies which made Michigan's jasper ore economic. The process combines the unique advantages of the traveling grate and the rotary kiln and provides genuine fuel savings through use of hot process gases to pre-heat and dry the pellets. When gases are finally exhausted to atmosphere, they have been reduced from 2400°F to as low as 250°F.

'Cliffs and Ford Dedicate the Humboldt Plant

THE HUMBOLDT MINE, jointly owned by Cleveland-Cliffs Iron Co. and Ford Motor Co., has opened a 650,000 tpy plant near Ishpeming, Mich., to produce high grade iron ore pellets from comparitively low grade jasper rock.

"This development of a high iron content ore from the vast low grade reserves of the Lake Superior region offers the prospects of economic rebirth for the area," commented Walter Sterling, 'Cliffs chairman and chief executive officer, at the opening ceremonies last month.

Sterling added that Cleveland-Cliffs is convinced of the future possibilities of continuing shipment of a high quality product from the range if large capital investment necessary for the work will be permitted.

Humboldt, which started up in February 1954, mines and improves the low grade (average 30% Fe) specular hematite jasper ores of the region. It is the Michigan counterpart of the taconite developments of the Mesabi Range. They are similar in that both are designed to run 12 months of the year, but are different in physical characteristics of the ore and in the methods used to up-grade it.

Heart of the pelletizing facility is the "Grate-Kiln" system designed and built by Allis-Chalmers Manufacturing Co. This two-line plant is the first installation of the "Grate-Kiln" applied to iron ore agglomeration and is the final segment in the Humboldt operations that include a large open pit ore reserve, a complete crushing-grinding circuit, and a beneficiation set-up.

"Grate-Kiln" consists of equipment for transforming finely ground 62% iron ore concentrate into green or unheat-treated balls for uniform size, a traveling grate which serves the dual function of dryer and preheater, a 120-ft rotary kiln which fires the balls into finished pellets, and an annular cooler which recovers heat from the pellets for use within the system and brings the pellets down to a safe handling temperature.

According to Allis-Chalmers, fuel economy in the process results from the re-use of exhaust gases from one stage of the system to support reactions in others. Hot gases recovered from cooling the final pellets reduce the fuel required in the kiln. Hot gases leaving

the kiln pass twice through the continuous bed of pellets which move along on the chain-type grate. In this way the pellets are dried and pre-heated prior to entering the rotary kiln where final heat treatment is accomplished resulting in a hard, uniform end product.

Ford representative at the plant unveiling, vice-president-body group Irving A. Duffy, summarized the potential of this Humboldt development. "In effect," he said, "the magic of Humboldt is the converting of deposits heretofore considered as nothing but 'country rock' into huge iron ore reserves."

Mr. Sterling attributed the rebirth of mining on the Marquette Range to the success of the Humboldt flotation process and the fuel-saving Grate Kiln system.

The new plant will cost between $15- and $16-million, and represents an investment of about $22 per ton (long) capacity of pellets per year. This is about half the capital investment required for taconite, which runs about $33 to $40 per long ton capacity of pellets per year. Mr. Sterling noted that the lower cost for the Marquette Range is due in part to an existing labor market, power and transportation facilities. The market price of the pellets is about $14.50 per long ton at lower lake ports. Shipping costs run about $2.75 per long ton at present rates.

Ford will not take the entire output of the new plant, but will have first call on amounts needed to fill its requirements.

Cleveland-Cliffs expects to increase the output from the present level of 650,000 tpy to 6- to 7-million tons over an 8- to 10-year period. That will mean an estimated total investment of $150-million by the partners. Some 200-million tons of jasper in the area is believed amenable to the present process.

The 30% Fe hematite is mined by 5-cu yd P&H shovels after drilling by jet piercing rigs (Cliffs is experimenting with rotary and down-the-hole rigs as well) and loaded into 40-ton Dart and Euclid trucks.

In the flotation process, about 3% of the total weight of the ore is discarded by spirals, because the slimes interfere with the process. See E&MJ, August 1954, p100. Final concentrate is reground from 45% minus 375 mesh to 75% minus 375 mesh to permit formation of superior pellets.

Four 9x30-ft pelletizing drums lined with cement and fitted with internal reciprocating scrapers feed the two Grate-Kiln lines. See caption and drawing above.

Underground mines existed at the Humboldt location as early as 1864, producing an ore which was shipped direct from the mines without processing. Direct shipping ore ran out in 1920, and the mines were abandoned.

Contractor for design and construction of the pelletizing plant was the Arthur G. McKee company of Cleveland.

(News continues on p 130)

As We Went to Press . . .

Cerro de Pasco has announced it will spend $6.8-million for two plant additions in Peru, at La Oroya and at Cerro de Pasco.

La Oroya electrolytic zinc plant will have capacity increased from 32,000 to 52,000 tpy by June 1962. The concentrator at Cerro is being expanded to accommodate increased volumes of copper and lead-zinc ores. The latter expansion is to be completed at year-end 1961, and will increase output of Pb-Zn from 42,000 to 65,000 tpm and Cu from 35,000 to 50,000.

The Nicaro nickel plant in Cuba, a U.S. Government-owned and GSA-operated facility in Oriente Province, will be closed down. The plant has been producing some 25,000 tpy Ni, but had been unable to ship large quantities to the U.S. because of imposition of the law which made the Fidel Castro government sole sales agent for mineral production from the island.

Wabush Iron Co. Ltd.'s second large shipment of concentrates from the pilot plant at Wabush Lake, Labrador was delivered to the Hamilton, Ont. works of Steel Company of Canada.

The 18,000-ton shipment, and its 12,700-ton predecessor in August, are being sintered and tested by Stelco and Inland Steel for the benefit of the Wabush Iron owners, which also includes Youngstown Sheet & Tube, Interlake Iron, Pittsburgh Steel and Pickands Mather & Co.

A third shipment, this month, will go to Youngstown for similar tests. The Wabush pilot plant, which uses full-size equipment, is presently producing about 300 tpd of 64% Fe concentrate from the 37% ore found in the Labrador trough.

A new uranium process for uranium ores "down to 0.05% U_3O_8" has been announced by Hack Engineering Co. of Denver. The firm has been testing Wyoming schroeckingerite for six months, and claims a total reagent cost of less than 20¢ per ton of ore processed; a 50% reduction in the investment for mill construction; and elimination of stainless steel or rubber-lined equipment.

Lucky June Mining Co., Rawlins, Wyo. has contracted with Hack for construction of a small plant at their mine.

Beryllium Resources Inc. hopes to have construction of a mill near its Spor-Topaz Mt. (Utah) beryllium deposit under way in about nine months, according to Dr. Norman Williams, vice president and chief geologist of the firm.

Dr. Williams described the ore to the Utah Securities Dealers Assn. in Salt Lake late last month, and noted that it is amenable to acid treatment and flotation. Such a process has been developed by Dr. E. Van Dornick of Dynamic Metals Corp., a sister firm of Beryllium Resources, with recoveries of about 90% from the Topaz ores in pilot plant tests. Dr. Williams said current exploration is under way to establish mine development.

New Mylamaque Explorations Ltd. has contracted with Koppers Co. and Strategic Materials Corp. for construction of a $14-million concentrator and direct reduction iron plant near Kingston, Ont.

The Tariff Commission, late last month, "found no reason" to change current lead-zinc import quotas, set two years ago at 80% of the 1953-1957 average on a country-by-country basis. The new administration in January must tackle it now (p. 28).

WASHINGTON IMPACT

Highlights

POLITICS IN LAS VEGAS—Nevada's glitter city steals the spotlight from Washington this month, hosting the annual meeting of the American Mining Congress. With the Undersecretary of the Interior Dept., the Vice-Chairman of the Tariff Commission, and a score of influential mining-state Senators and Congressmen on the agenda, more Federal metal-mineral policy news will be made in Las Vegas than in the Nation's Capital. Here are some of the highlights:

Partisan pitches—casting an eye toward the November election, Senators Frank Moss (D-Utah) and Thruston Morton (R-Ky.) will outline their respective parties' natural resources planks, and try to persuade mining industry executives and workers why they should vote Democratic or Republican next month.

Moss bases his pitch on charges of "cold-hearted Republican neglect" of domestic mining interests. He cites Eisenhower's veto of small lead-zinc mine operators' price-subsidy legislation, Tariff Commission in action on various industry appeals for more import protection from foreign competition, and Administration programs of foreign aid to overseas producers of copper, lead, zinc, antimony, cobalt, and manganese.

He also accuses Vice-President Nixon of refusing industry invitations to spell out his ideas on national mining policies.

Morton argues that the Administration has done more for business generally, and mining specifically, than the Democrats, pointing to new government outlays for research and development, social benefits such as distressed area relief and workers' compensation, and Interior Secretary Fred Seaton's proposals for selected domestic mining subsidies, defeated by a Democratic-controlled Congress last year.

Subsidies vs. protection—neither partisan exponent offers a specific legislative and administrative program for Federal aid to the mining industries next year. The Democrats apparently lean toward subsidies rather than import protection. Candidate Kennedy has said publicly he would have signed the small lead-zinc subsidy bill, and consistently hits the theme of Federal responsibility in developing natural resources.

The Republicans endorse mineral development, argue they have spurred efforts in this area through government incentives.

But the issue is not entirely clear-cut. Kennedy has talked trade protection for mineral, textile, oil and shoe industries, while at the same time telling business audiences they must be prepared for "sacrifices, not subsidies." The Republicans have declared for trade expansion, and repudiated subsidies except for farm groups. Candidate Nixon has endorsed plans for stepped-up U.S. economic aid for Latin America, including its mineral production.

Some Democrats—Rep. Lee Metcalf, running for retiring Sen. James Murray's seat from Montana, and Reps. Wilbur Mills of Ark. and Hale Boggs of La., for example—have publicly favored the closing of tax loopholes, including reducing depletion allowances. Republican candidates, and Murray himself, have denounced this view.

Skeptical industry observers in Washington, watching and listening to the pitches in Las Vegas, have their own prediction: No substantial new metal-mineral mining subsidies or trade protection next year, no matter who wins the election.

MEANWHILE, BACK IN WASHINGTON—Las Vegas has not completely pushed Washington out of the mining industry news, at that. Two important government trade policy decisions are due shortly. One is the Tariff Commission's periodic review of existing import quotas on lead and zinc, scheduled for early October as this issue of E&MJ went to press. The other is the Administration's final list of products on which it will offer import concessions at International General Agreement on Tariff and Trade negotiations in Geneva next January.

At press time, Tariff Commission was reported leaning toward a recommendation that present lead-zinc import quotas be kept in effect for another year without change. Earlier the Commission was considering urging a liberalization of zinc quotas, and this is still a possibility.

Gold, Silver Subsidies Gain Support for '61

GOLD AND SILVER LEGISLATION is a hardy perennial subject in Washington, and next year will be no exception. Already, plans are being drawn for a new attempt to enact subsidy legislation for domestic miners, if not raise U.S. prices.

The Congressional record to date is bleak. Gold-silver bills almost never pass; last session they did not even get House or Senate Committee airings. The Treasury Dept. steadfastly opposes such measures, on grounds that a rejigger in gold-silver prices or production, even if limited to the U.S. market alone, would result in a world money market reaction that could undermine the U.S. dollar in international finance.

Next year, however, a new effort will be made to build a case for some kind of Federal aid for domestic producers of the precious metals.

The Senate Interior Committee staff is at work this month on a new study of domestic and world gold and silver markets, production, prices, labor and other factors. The aim is to come up with a revised, or perhaps new, formula for supporting domestic gold and silver mining that would be acceptable to international financial experts in the U.S. Treasury and overseas.

The argument for Federal gold-silver legislation has received two new boosts.

One is the continuing outflow of gold from the U.S. Treasury, which in recent months has hit record levels. The other is a behind-the-scenes prediction from economists that the U.S. faces a silver shortage severe enough to affect Treasury coinage requirements in the near future.

Despite new concern, however, present opposition to any hike in even domestic prices of the two metals remains strong. For that reason, Committee staffers are thinking more in terms of legislation aimed at subsidizing domestic production rather than raising even nonmonetary market prices.

On the other hand, proponents of gold-silver legislation are toying with the thought that a new Treasury Secretary might be less adamant against a domestic price hike in gold or silver than have been his predecessors. Washington experts close to both Democratic and Republican political camps tend to view this hope as an idle one, however.

Latin Metal-Minerals Will Get U. S. Aid Slice

U.S. FOREIGN AID to Latin America will be boosted substantially next year, no matter which party wins the White House and Congress. And a significant chunk of it will go to Latin American metal-mineral producers.

This trend has emerged clearly out of recent U.S. inter-American economic conferences, particularly the meeting of Organization of American States Eco-

nomic and Social Council at Bogota, Colombia, in September.

The Act of Bogota, signed by Under Secretary of State C. Douglas Dillon with Congressional approval in principle in its third session in August, is concerned primarily with the new U.S. aid to so-called social development projects —schools, housing, public health, and the like.

But the document also commits the U.S.—a commitment which has been endorsed by both Presidential candidates, incidentally—to increased economic aid to help Latin America diversify and improve its industrial plant, including production of iron ore, copper, lead, zinc, and numerous other nonferrous metals and minerals.

Further, the Bogota Pact lays the groundwork for greater U.S. economic policy cooperation with Latin American plans for regional market and industrial integration and commodity stabilization efforts.

U.S. officials, in their future talks with Latin American governments under the OAS and the new Inter-American Development Bank, will stress the need for Latin America to improve its climate for U.S. investment and exports. But at the same time, the official U.S. attitude will also be one of trying to help Latin American countries improve their commodity earnings, while exploring ways of reducing their dependence on these items.

Geophysical Research May Qualify in Mine Claiming

GEOPHYSICAL RESEARCH for new metal-mineral ore veins is becoming a hot topic in Washington. Congressional mining committees are considering introducing new enabling legislation next session.

The problem basically is a legal one. Federal laws controlling private mining claims are relatively restrictive. Geophysical research involves primarily broad air surveys over huge areas to spot possible mine potential.

The American Bar Association, in its recent Washington convention, lent support to a proposal to exempt airborne geophysical research from mining claim law limitations, until a potential lode is spotted and explored.

Criticism is anticipated from small mine claim seekers who may protest that a change in existing laws would give large mining interests an unfair advantage.

Proponents argue that once a potential vein is spotted from the air, rights to develop it would be subject to the same stake-out laws that presently apply to all claims seekers. The proposed legislation, they contend, would merely give explorers the right to look for possible lodes from the air.

Backers of the idea also argue that all modern exploration techniques are needed if domestic mining industries are to expand.

Labor This Month

SHORTER HOURS, SAME PAY: The Mine, Mill and Smelter Workers' 55th convention set this bargaining goal for 1961 negotiations in the nonferrous industry. At last month's meeting in Denver, MMSW delegates voted the 32 or 35-hr week "without loss in pay" as the number one target when negotiations get under way for new contracts ending June 30 next year. This, a convention resolution said, "is the most effective and obvious answer . . . to job security . . . threatened by the growth of speedup devices, mechanization and automation with its resultant shrinkage of jobs in nonferrous metals and other industries."

DEMOCRATIC—WITH RESERVATIONS: Officials of Mine-Mill are noticeably cool towards the Kennedy-Johnson ticket in next month's elections—although they like the Democratic platform. Joining a few other unions—notably the International Brotherhood of Teamsters—in reservations about the presidential aspirant, MMSW president John Clark tipped the sentiment by a reference to the Kennedy-Landrum-Griffin reform bill. AFL-CIO president George Meany, Walter Reuther, Dave McDonald and other union officials favoring Kennedy keep his name off the bill's label. They claim he kept the measure from being more stringent towards unions.

AT THE UNITED STEELWORKERS' CONVENTION last month, Kennedy revealed some labor legislation ideas, including one that rated a cool reception from MMSW and McDonald's union. Though both favor the shorter work week, the Democratic candidate advised he is against an hours cutback because of the Communist threat. However, he proposed new solutions for settling National emergency disputes, including a plan that would give the White House a series of one-shot solutions, besides the Taft-Hartley 80-day injunction. These would allow the President to invoke, at his choosing, such weapons as mediation, fact-finding, retroactive pay orders, and government seizure. But, said Kennedy, he opposes compulsory arbitration. Vice-President Nixon, who helped settle the steel strike, has also suggested more free-wheeling mediation and other outside help in tackling critical strikes.

UNIONS FACE MONEY TROUBLES: A combination of membership cutbacks and costly strikes is forcing some bigger labor unions to revamp their dues and strike benefit rates. At their recent conventions, the Machinist and Electrical Workers unions both moved to assure financial solvency. James B. Carey's Electrical Workers proposed a $1 hike in monthly dues, to boost their $2-million defense fund as they headed into showdown negotiations with General Electric and Westinghouse. This set the minimum monthly dues at $4—35 cents of which must go into the union defense fund. Though IUE hasn't been involved in heavy strikes —at least up to now—the fund levels have declined because of the drop in membership. Only some 296,000 members pay dues, although the union claims a 400,000 membership. In the case of the Machinists union, the proposal was to trim strike benefits from $35 to $25 a week. A rash of IAM strikes this year in railroads, aircraft and machine shops depleted the fund by an average $500,000 a month. Payments were finally halted altogether, so the fund could be rebuilt to $2-million.

TEAMSTER JUGGERNAUT SLOWS DOWN: Despite its corruption troubles over the past three years, the International Brotherhood of Teamsters has soared to 1.6-million members—and is still climbing faster than any other union. Now, the IBT is showing some weaknesses. In two key tests last month the truck union:

Lost a key National Labor Relations Board election to the Seafarers International Union. In the IBT's attempted organization of Great Lakes seamen, the Teamsters were defeated 277-171 in an attempt to represent 550 unlicensed sailors of Boland & Cornelius's 19-ship fleet. SIU claims this scuttles Teamster plans for Great Lakes jurisdiction.

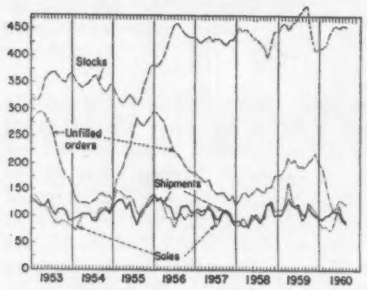
Was trounced in a series of NLRB election votes among 20,000 New York City taxicab drivers. Out of 58 elections covering some 2,000 taxicab fleets, the Teamsters won only one. Fifty-six other units voted "no union."

MARKETS

Custom Smelter Copper Cut to 31c; Chuqui is Struck; Cutback at Arvida

PRICES OF NONFERROUS METALS were virtually unchanged in September, according to the E&MJ metal price index. The September figure was 126.0% of the 1947-49 average, unchanged from last month, 0.1% below July; 0.1% above June. The index has not varied more than 0.1% for the past seven months. In September the price of tin dropped to 102.274¢ a lb from 102.940¢ the previous month without influencing the figure. Other metals were unchanged.

U.S. Copper Fabricator Data



Data in thousands of short tons from U.S. Copper Assn. The sales and shipment series are related only to purchases of refined copper by the fabricators, including copper refined by custom smelters from their intake of scrap and concentrates. All statistics refer to brass mills, wire mills and foundries. All series are for fabricated products except stocks which are of refined copper and copper in process. August is the last month indicated. Sales and shipments series are two months moving averages.

Sales of copper reported to E&MJ in September were for the sixth consecutive month unchanged at 33¢ a lb delivered. Domestic pricings were again quite low though up about 7% from August. Foreign sales tapered off after a fast start. Nonetheless, they were very high, only 1,500 tons below the record amount reported in August. Smelters held to 33¢ all month; dealers sold at 31-31¼¢.

Workers at Chuquicamata (Anaconda) in Chile walked out on October 1. Unfounded rumors of a quick settlement plunged the LME £5½ on October 3. Chilean workers, among the highest paid in the country, were said to be well able to afford the strike. Demands, which at the offset of negotiations called for a 70% increase, had been cut at press time and Anaconda had boosted its offer to 21%, but there was no indication of progress. Labor leaders had been authorized to resume talks. It did not appear that the industry was overly concerned with the threat of curtailment, nor was an extended strike forecast. The Chilean government was striving for accord owing to its disaster-wracked treasury.

Chuquicamata produced about 300,000 tons of refined and blister copper in 1959 (25,000 tons per month). Output in 1960 was not running as high. Some 7,000 workers were out.

Early month copper lightning struck again on October 3, when in the teeth of the Anaconda strike, American Smelting & Refining Co. slashed its price 2¢ to 31¢ a lb delivered, effective the first market day of the month (Oct. 3). Other smelters followed.

The action was anticipated. The belief that smelters might delay cutting prices were a strike to develop dissolved late in September. Improvement in the outlook for the Congo, a let-up in European demand, a plunging LME and lower smelter scrap-buying prices primed the cut. The faltering U.S. economy made 31¢ copper tempting in September. Dealers sold well domestically at 31-31¼¢. The 2¢ spread between their price and the smelter price created what one dealer called an artificial boom.

When London dipped to £225 on Oct. 3, the spread between the U.S. price of 33¢ and the London price was nearly 5¢. At slightly over 28¢ plus 1.7¢ tariff and freight and insurance costs, copper was available for less than 31¢. Smelters were buying No. 2 scrap at 24¢, enabling them to sell profitably in 90 days at about 29½¢. Smelters were uncertain as to just how much copper would be moved at the new price.

World refined stocks moved up 12,000 tons during August. Deliveries stimulated by Congo and Chilean uncertainties rose about 30,000 tons outside the U.S. U.S. fabricators shipped and booked more new business in August than in July, but were running arrears of 1959 and slipping when two-month moving averages were considered.

The race to eliminate the alumina stage in the reduction of aluminum picked up speed during the month with the announcement by French producers Pechiney and Ugine, Europe's largest, that they will jointly construct a pilot plant by the end of the year for the purpose of investigating several new processes before agreeing to enter production on one of the plans. This word and the previous announcement by Aluminium Ltd. has probably triggered an international run for patents. Research expense over the next few years will undoubtedly cancel profits from lower cost output, but with international competition for markets sharper than ever before, long-run optimism, ever present in the aluminum industry, will depend on progress along cost-cutting lines.

August aluminum output was 172,973 short tons, compared with 177,564 in July. Output is about unchanged from a year ago, but increased capacity since then has caused the per cent of operating capacity to slide. The U.S. was at 82.5% in August, compared with 84.7% last month and 89% in August 1959.

Alcan cut out one potline at its Arvida, Que. smelter during the month. The annual capacity removed was 17,000 tons or about 2½%. Earlier in the year the company had upped production to 690,000 tpy, a little more than 90% of capacity. A weakness in North American markets necessitated the move, the company said.

In 1951 certain large shareholders of Aluminum Ltd. in Alcoa were ordered by U.S. courts to dispose of their holdings. Some 350,000 shares were recently sold virtually completing the disposal order.

Industry stocks surged 33,600 tons by the end of July to 203,626. Shipments fell 6,000 tons.

The International Lead-Zinc Study Group met in Geneva and recommended that certain countries maintain voluntary supply restrictions on lead on the basis of heavy world stocks. They forecast a lead surplus of 21,000 tons for 1960 based on improved activity in the second half.

Lead sales surged in the final two weeks of the month enabling September to equal August after a miserable start. The 12¢ price figures to hold in October.

The Study Group came up with a whopping 74,000-ton estimate of the zinc surplus for 1959, but made no recommendations. Consumer stocks were considered no more than normal. September sales of zinc, led by SHG but with some improvement in PW, were up sharply the last week of the month and exceeded August.

Matthiessen & Hegeler shut down its last two furnaces at La Salle, Ill. canceling about 1,200 tons of capacity per month. Miners at five Eagle Picher zinc mines in Illinois and Wisconsin walked out on October 3. They are seeking a 10¢ pay hike. Bunker Hill and N.J. Zinc, totaling 16,000 tons per month output continued struck in September. The 13¢ price is firm.

The National Lead Co., effective Jan. 1, 1961, will buy all output of lead, SHG zinc and cadmium from Bunker Hill's Kellogg, Ida. plant, except that which is needed by BH for fabricating. National Lead will sell the primary metals along with its regular line of products.

The Tariff Commission has recommended to the President that present quotas on unmanufactured lead and zinc be maintained. It indicated that there had been no basic change in competition between domestic and imported lead and zinc.

U.S. producers boosted the price of cadmium 10¢ a lb to $1.60 for less than ton lots; $1.50 for large lots, effective September 28. Foreign antimony prices are higher.

Average Prices September (E&MJ Quotations)

Cents per lb unless otherwise indicated:

Copper:	
Electro, domestic refinery	32.600
Electrolytic, exports refinery	28.611
Electrolytic, c.i.f. Cont'l ports	29.556
Lead:	
Common, New York	12.000
Common, St. Louis	11.800
Silver:	
Silver, New York, per oz	91.375
Silver, London, pence per oz	79.250d
Zinc:	
Prime, Western, East St. Louis	13.000
Prime, Western, delivered (g)	13.500
Tin:	
New York Straits	102.274
Gold, per oz, U.S. price	$35.000
Sterling, Exchange	281.271
Quicksilver, per flask	$209.000
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Antimony for. 99%	23.589
Palladium, troy oz	$24.000
Platinum, refined, per oz	82.000
Cadmium (a)	141.429
Cadmium (b)	151.429
Al, 99½% unalloyed ingot	26.000
export, ingot	23.250
Magnesium, ingot	35.250
Nickel, (f)	74.000
Bismuth	$2.250
Cobalt	$1.500

Domestic quotations, unless otherwise stated are in cents per lb. Sterling exchange checks, in cents. Quicksilver per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.
(h) 2c duty extra.

Free Gold Market

International gold dealing volume increased 19% during September to the highest level in over two years. Bar prices in London reached $35.26½, an all-time high since the reopening of the market in 1954. Most other centers listed higher coin than bar prices. Gold futures again in active demand showed a volume of transactions averaging $1.5-million daily with a carrying charge of 4½% p.a. U.S. gold stocks continued to decline reaching a new low of $18.697-billion. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	Coins		Bars (12.5 kg)	
	Aug. 31	Sept. 30	Aug. 31	Sept. 30
New York transit	.....	.....	$35.08⅛	$35.08⅛
Manila	$40.25	$40.50	36.00	36.10
Hong Kong	47.50	47.25	39.25	39.30
Bombay	53.25	53.00	53.00	52.50
Beirut	39.65	39.70	35.33	35.35
Paris	39.90	40.10	36.05	35.80
Buenos Aires	39.25	39.70	35.75	35.88

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper

Based on flat price and E&MJ average price sales in U.S. for month of September reported by American Smelting & Refining Co. electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered consumer's plant	32.750 lb
F. o. b. refinery	32.350 lb

Major Metals

U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

Sept. 1960	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (c)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Ingot 99% U.S. Dest.	Straits Tin New York.
1	32.600	28.600	29.545	12.000	11.800	13.500	13.000	26.000	102.375
2	32.600	28.650	29.595	12.000	11.800	13.500	13.000	26.000	102.625
5	Holiday	28.700	29.645			Holiday			
6	32.600	28.650	29.595	12.000	11.800	13.500	13.000	26.000	102.500
7	32.600	28.675	29.620	12.000	11.800	13.500	13.000	26.000	102.250
8	32.600	28.500	29.445	12.000	11.800	13.500	13.000	26.000	102.250
9	32.600	28.675	29.620	12.000	11.800	13.500	13.000	26.000	102.250
12	32.600	28.700	29.645	12.000	11.800	13.500	13.000	26.000	102.250
13	32.600	28.575	29.520	12.000	11.800	13.500	13.000	26.000	102.625
14	32.600	28.803	29.745	12.000	11.800	13.500	13.000	26.000	102.250
15	32.600	28.600	29.545	12.000	11.800	13.500	13.000	26.000	101.750
16	32.600	28.725	29.670	12.000	11.800	13.500	13.000	26.000	102.000
19	32.600	28.775	29.720	12.000	11.800	13.500	13.000	26.000	102.125
20	32.600	28.775	29.720	12.000	11.800	13.500	13.000	26.000	102.000
21	32.600	28.925	29.870	12.000	11.800	13.500	13.000	26.000	102.250
22	32.600	28.750	29.695	12.000	11.800	13.500	13.000	26.000	102.375
23	32.600	28.675	29.620	12.000	11.800	13.500	13.000	26.000	102.125
26	32.600	28.450	29.395	12.000	11.800	13.500	13.000	26.000	102.250
27	32.600	28.400	29.345	12.000	11.800	13.500	13.000	26.000	102.250
28	32.600	28.325	29.270	12.000	11.800	13.500	13.000	26.000	102.250
29	32.600	28.300	29.245	12.000	11.800	13.500	13.000	26.000	102.750
30	32.600	28.225	29.170	12.000	11.800	13.500	13.000	26.000	102.250
AVERAGES FOR MONTH									
Sept.	32.600	28.611	29.556	12.000	11.800	13.500	13.000	26.000	102.274
AVERAGES FOR WEEK									
Sept. 7	32.600	28.655	29.600	12.000	11.800	13.500	13.000	26.000	102.438
14	32.600	28.650	29.595	12.000	11.800	13.500	13.000	26.000	102.325
21	32.600	28.760	29.705	12.000	11.800	13.500	13.000	26.000	102.025
28	32.600	28.520	29.465	12.000	11.800	13.500	13.000	26.000	102.250
CALENDAR WEEK AVERAGES									
Sept. 2	32.600	28.925	29.870	12.000	11.800	13.500	13.000	26.000	102.325
9	32.600	28.640	29.585	12.000	11.800	13.500	13.000	26.000	102.313
16	32.600	28.680	29.625	12.000	11.800	13.500	13.000	26.000	102.175
23	32.600	28.780	29.725	12.000	11.800	13.500	13.000	26.000	102.175
30	32.600	28.340	29.285	12.000	11.800	13.500	13.000	26.000	102.350

THE above quotations for major nonferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered U.S. basis add 0.400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deducted.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West and West effective Apr. 1, 1960, commanded a premium of 1.50c per pound over the current market for Prime Western; Special High Grade 1.75c effective Apr. 1, 1960.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Sept. 1960	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.375	79.250d.	281.1700	250s. 2¼d.
2	91.375	79.250d.	281.1140	250s. 2¼d.
5	Holiday	79.250d.	Holiday	250s. 3¼d.
6	91.375	79.250d.	281.1500	250s. 4d.
7	91.375	79.250d.	281.1960	250s. 4¼d.
8	91.375	79.250d.	281.3060	250s. 5d.
9	91.375	79.250d.	281.2740	250s. 4¾d.
12	91.375	79.250d.	281.3940	250s. 5¼d.
13	91.375	79.250d.	281.4320	250s. 5¼d.
14	91.375	79.250d.	281.5040	250s. 3¼d.
15	91.375	79.250d.	281.6320	250s. 2¾d.
16	91.375	79.250d.	281.5800	250s. 2¼d.
19	91.375	79.250d.	281.5800	250s. 3¼d.
20	91.375	79.250d.	281.4700	250s. 3¾d.
21	91.375	79.250d.	281.3980	250s. 5¾d.
22	91.375	79.250d.	281.4620	250s. 6d.
23	91.375	79.250d.	281.2600	250s. 5¼d.
26	91.375	79.250d.	280.9020	250s. 8¾d.
27	91.375	79.250d.	280.8100	251s. ⅛d.
28	91.375	79.250d.	281.0325	250s. 11¼d.
29	91.375	79.250d.	281.0040	250s. 9¼d.
30	91.375	79.250d.	281.0280	250s. 9½d.
AVERAGES FOR MONTH				
Sept.	91.375	79.250d.	281.271	—
AVERAGES FOR WEEK				
Sept. 7	91.375	79.250d.	281.158	—
14	91.375	79.250d.	281.382	—
21	91.375	79.250d.	281.532	—
28	91.375	79.250d.	281.093	—

Calendar Week Averages: New York Silver: Sept. 2, 91.375; Sept. 9, 91.375; Sept. 16, 91.375; Sept. 23, 91.375; Sept. 30, 91.375.

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS (*Continued*)

London Metal Exchange Quotations

Sept. 1960	Copper — Cash Bid	Copper — Cash Asked	Copper — 3 Mon. Bid	Copper — 3 Mon. Asked	Lead — Current Month Bid	Lead — Current Month Asked	Lead — 3 Mon. Bid	Lead — 3 Mon. Asked	Zinc — Current Month Bid	Zinc — Current Month Asked	Zinc — 3 Mon. Bid	Zinc — 3 Mon. Asked	Tin — Cash Bid	Tin — Cash Asked	Tin — 3 Mon. Bid	Tin — 3 Mon. Asked
1	234	234¼	234¼	234½	71	71¼	71¼	71⅜	85⅜	86	85¾	86	802½	803	802½	803
2	235½	235⅝	235½	235⅝	70¼	70½	70⅝	70⅞	85⅝	85⅝	85⅝	85¾	803½	804½	803½	804
5	235	235¼	234¾	235	70¼	70⅝	70⅝	70¾	85⅜	85⅞	85¾	86	801½	802	802	802½
6	234½	234⅝	235	235¼	70⅛	70¼	70½	70⅝	85⅜	85⅞	85¾	86	801	801½	801½	802
7	236	236¼	236	236¼	70⅝	71	70¾	71	86⅛	86⅝	86⅛	86¼	800	801	800	800½
8	236	236¼	236	236¼	70¼	70⅝	70½	70⅝	86⅜	86⅝	86⅜	86⅝	799½	800½	799	799½
9	235	235¼	235½	235⅝	70¼	70⅝	70⅝	70½	86⅜	86⅞	86¼	86½	800	802	799½	800
12	235	235½	235½	235⅝	70⅜	70½	70⅝	70¾	87⅛	88	87⅛	87⅜	805	808	803	804
13	234	234½	234½	234⅝	70⅝	71	71	71½	88⅜	88⅞	88	88½	816	818	810	811
14	235¼	235½	235¾	236	70⅞	71	71	71½	88½	88¾	87¾	88	810	811	805	806
15	236¼	236½	237	237¼	70¼	70⅝	70⅝	70⅝	89	89¼	88¼	88½	804	805	801½	802
16	236⅜	237	237¼	237½	70¼	70½	70½	70⅝	88¼	88⅜	87⅝	87⅞	805	805½	802	802½
19	237⅜	238	237⅜	238	70¼	70¼	70¼	70⅝	87⅝	87⅝	87	87¼	805½	806	803	803½
20	236¼	236½	236¼	236½	69⅞	70	70	70½	86¼	86½	85⅝	86	805	805½	802½	803
21	236¼	236½	237	237¼	69⅞	70	70½	70¼	87	87½	86¼	86⅝	806½	807	804½	805
22	235	235¼	236	236¼	69½	69¾	69¾	69⅞	87¼	78⅝	86½	86¼	806	806½	804	804½
23	234	234¼	235	235½	69¼	69½	69¾	69⅞	87¼	87⅜	85⅞	86	805½	806	803½	804
26	233	233½	234	234½	68½	68¾	68¾	69	86⅜	87	85½	85⅝	804½	805	801½	802
27	232¼	232½	233¼	233½	68½	68⅝	68⅞	69	86⅜	87	85½	85⅝	804½	805	801½	802
28	231¾	232	233	233¼	68½	68¾	69¼	69½	87¼	88	86	86⅛	806	806½	803	803½
29	230¾	231	232	232¼	68⅝	68⅝	69⅛	69⅜	87	87¼	85⅜	85⅝	804	804½	801¼	802
30	230½	230¾	231¾	232	68⅝	68⅞	69⅜	69½	86¾	87	85⅜	85½	803½	804	800½	801
Av'g's	£234.705		£235.261		£69.946		£70.244		£87.139		£86.446		£804.932		£802.784	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.0%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty extra.

MISCELLANEOUS METALS

Sept. 30, 1960

Aluminum ingot, 99.9% lb		28c
Antimony, spot, lb, less than carload, in cases		32.59c
In bulk, carload lots, f.o.b. Laredo		29.00c
Imported, 10 ton min. (p), 99% Duty not paid	23¾ —	24c
Bismuth, ton lots, lb		$2.25
Cadmium, ton lots delivered, lb		$1.50
small lots		$1.60
Calcium, lb, ton lots, 98%, cast		$2.05
Chromium, 97% grade, lb, contract delivered		$1.29
Cobalt, 97 to 99%, per lb effective 3-1-60		$1.50
Germanium, per gram, 10,000 gram lots	(d)28.15c—(c)(d)29.95c	
Indium, troy oz	$1.35 —	$2.25
Lithium, lb, 98%	$9.00 —	$11.00
Nickel, cathodes, lb (a)		74c
Other sales, regular sellers		74c
Sales by dealers, etc		74c
Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr. 16		35¼
Palladium, troy oz	$24 —	$26
Platinum, troy oz	$81 —	$85
Quicksilver, flask of 76 lb, 25 flasks or more	$209 —	$212
Selenium, 99 plus %, lb—(Feb. 19, 1958)	$6.50 —	$7
Silicon, minimum 98%, carloads, lb		19c
Semi Conductor grade, lb		$360
Tellurium, lb		$4.00
Thallium, 100 lb or more		$7.50
Titanium, 99.3% plus, grade A-1, max. 3% Fe, lb (b)	$1.50 —	$1.60

(a) Effective Dec. 6, 1956; including U. S. duty; (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium ore, imported, 10% BeO, (b) stu; spot	$31.75 —	$32.50
term contracts	$34 —	$34.50
Chrome ore per long ton, f.o.b. cars Atlantic ports, dry:		
44% Cr_2O_3 no ratio	(a)$19.75 —	$20.50
48% Cr_2O_3 3 to 1 ratio	$35¾ —	$38
Iron ore, Lake Superior, Lower Lake ports, lt		
Old Range bessemer		$11.70(e)
Mesabi bessemer		$11.60(e)
Mesabi non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$141.72
Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra., (n)87c—90c. Long-term contract nominal.		
Molybdenum ore, 90%, per lb of Mo f.o.b. mines		$1.25
Columbium-Tantalum, per lb, combined oxides 10 to 1 ratio	$1.18 —	$1.25
Tungsten ore, per stu of WO_3:		
Foreign 60%, c.i.f. U. S. ports, duty extra	$20 —	$20.25
U. S. scheelite, f.o.b. mill	$24 —	$25
Vanadium ore, per lb of contained V_2O_5 f.o.b. mines		31c
Zinc ore, Prime, 60% concentrate, Joplin, Mo., per ton		$80

(a) Nominal. (b) c.i.f. U. S. ports. (e) Effective 1958 shipping season.

METALLIC COMPOUNDS

Arsenous oxide (arsenic trioxide) lb, in bbl. carload lots N. Y. docks		4–5c
Cobalt oxide, 72⅓% to 73⅓%, per lb, effective Mar. 1, 1960	$1.15 —	$1.18
Copper sulphate, 100 lb. effective Nov. 6, '59		$13.00
Germanium dioxide, gm		16½c
Molybdic trioxide, technical, per lb of Mo	$1.46 —	$1.47
Imported, including 37c duty	$1.75 —	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4-9% C)		28¾c
Ferromanganese, 74 to 76%, per lb shipping point		11c
Ferromolybdenum, 58 to 64% Mo. lb of Mo contained	$1.50 —	$1.82
Ferrosilicon, 50% per lb of Si f.o.b. shipping point (3-1957)		14.60c
Ferrotungsten, 72 to 82%, lb of W contained		$2.15
Ferrovanadium, per lb of V delivered	$3.20 —	$3.40
Silicomanganese, max. 1½% C, lb contracts		11.6c
Spiegeleisen, per lt, 19—21% grade effective Jan. 22	$100.00 —	$102.50

NONMETALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,400–$1,725	Paper Stock	$120–$142
Crude No. 2	$750–$1,100	Waste	$75– $86
Spinning Fibers	$350– $565	Shorts	$22– $75
Shingle fibers	$180– $220		
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1	$1,522	Spinning fibers	$220–$787
Asbestos, Vermont, f.o.b. Morrisville:			
Spinning fibers	$353– $408	Waste, stucco or plaster	$86
Shingle stock	$181– $218		
Paper stock	$120– $142	Refuse or shorts	$41– $75
Barytes, f.o.b. cars:			
Georgia, crude, per ton			$18
Missouri, 94%, $BaSO_4$, per st	$16 —		$18
Crude off well grade, min. 4.3 sp gr, st (a)			$18
Imported, c.i.f. Gulf Ports, st	$16 —		$18
Bauxite, st, f.o.b. point of shipment:			
Domestic, crude, 50%, 8% Fe, 13% Si	(c)$12.25 —		$13.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, 60% Al_2O_3, 6% SiO_2, 1.25% Fe, 1–1–60			$7.25
Feldspar, bulk ton; f.o.b. plants:			
Potash or soda feldspar, 200 mesh, ceramic grade	$17 —		$20.50
Glass feldspar, white, 20 mesh			$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 —		$41
60% effective CaF_2	$33 —		$36
Acid 97% concentrate, bulk, ton			$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 —		$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$46
Mica—Domestic, f.o.b. mines. Punch 7c—12c per lb according to size and quality. Sheet clear 1½x2 in. 70c—$1.10; 2x2 in, $1.10 to $1.60; 2x3 in $1.60—$2.10; 3x3 in, $1.80—$2.30; 3x4 in, $2.00—$2.60; 3x5 in, $2.60—$3.00; 4x6 in, $2.75—$4.00; 6x8 in, $4.00—$8.00. Wet ground, very fine, $140—$155 per ton, Bulk sales, dry ground; $50—$55 per ton. Scrap $20—$30.			
Ocher, Georgia, ton in sacks	$26.50 —		$32.00
Sulphur, Mexican, for use in Mexico, metric ton, f.o.b. mines, depending on location	$21 —		$23
For export f.o.b. vessel, depending on grade	$20.50 —		$22
Actual prices received by U. S. producers approximate the Mexican export prices.			
Talc, f.o.b. works, ton:			
New York, purified	$18.00 —		$20.00
Vermont, extra fine			$12.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$50.00

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc., 100 lb	$5.30 —	$5.50

OWNERS REPORT:

How exclusive clam-action 4-in-1 MAKES MONEY where other rigs don't!

"4-in-1 break-out action saves time and shooting costs"

—Albert Boehman Coal Mine, St. Meinard, Indiana

Albert Boehman Coal Mine uses an International Drott TD-6 Four-in-One to strip overburden, clean the vein, and load out coal. "I particularly like the 4-in-1's (pry-over-shoe) break-out action which heap-loads the bucket fast, and usually saves 'shooting' costs. The 4-in-1 has the work-producing features of several machines in one." *Here his TD-6 Four-in-One is "digging coal"* directly from the vein it uncovered and cleaned. The 1⅛ cu. yd. TD-6 can apply a tremendous 18,600 lbs. of break-out force!

"Bottom-dumping 4-in-1 cleans itself out"

—Marion Young, Bloomington, Indiana

"I tried another rig for a month and had to clean out its bucket with a spade—and that slows you down with 600 to 700 lbs. of dirt stuck in it," states excavating-loading contractor Marion Young. "My bottom-dumping 4-in-1 cleans itself out when I flap the clam (hydraulically)." Here his 4-in-1 is loading wet river-bottom gravel. Exclusive 4-in-1 bottom-dumping eliminates the sticky materials problem!

"Our 4-in-1 replaces several other rigs"

—Joseph Borge & Sons, Inc., Swansea, Mass.

Joseph Borge & Sons, Inc., produce washed sand and gravel from open pits—use their TD-15 Four-in-One to strip overburden, load out, and recontour worked-out pits. Owner reports loading out 1,200-1,800 tons of material per 8 hrs. "Four-in-One versatility and capacity replace several rigs for us," states Vice-president, George Borge. "The clam-action also digs faster and dumps cleaner." Above, their 4-in-1 is "back-dragging" from gravel bank, to speed loading.

Why limit your income to what an old-style, single-action loader, or any other limited-duty rig can earn you? See how an International Drott 4-in-1 can give you a whole equipment spread of actions—and each action can double for one or more costly specialized machines. Prove Hydro-Spring performance protection. See your International Drott Distributor for a 4-in-1 demonstration!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

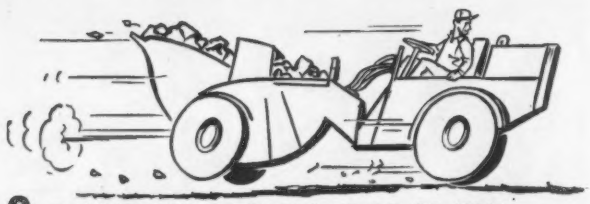
INTERNATIONAL HARVESTER

INTERNATIONAL®
DROTT®

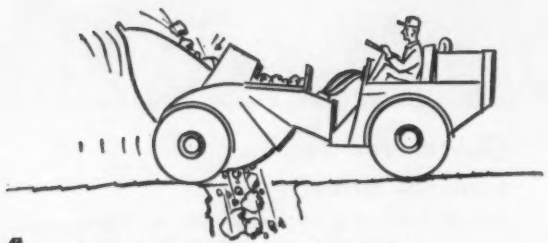
Why TRANSLOADER?

The Only Self-Loading Transport!

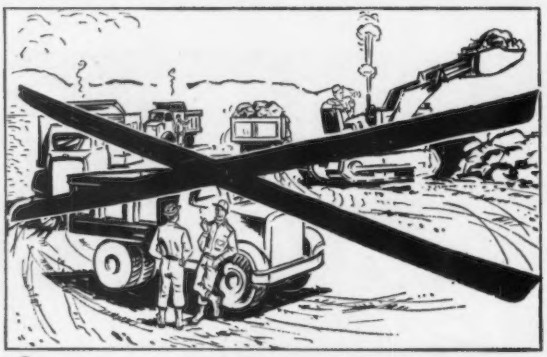
1. LOADS 6 TONS IN 49½ SECONDS!



2. TRANSPORTS AT SPEEDS UP TO 23 MPH — *either direction!*



4. DUMPS LOADS IN 15 SECONDS!



3. NEVER WAITS ON OTHER EQUIPMENT! S-D Transloader saves labor and machine costs wasted in multiple machine operation.

5. NO TURNAROUNDS REQUIRED! Returns immediately to reload! Travels at higher speeds than other equipment because of low center of gravity and articulated steering!

THIS IS WHY the S-D Transloader is more efficient than conventional equipment and methods of materials handling. But this is not all. The S-D Transloader way is the **lowest possible cost way** because:

1. **LOWEST ORIGINAL COST** for tons handled!
2. **LOWEST MAINTENANCE** due to extremely simple design and high quality of components . . . such as T-1 Steel, Cummings Engines, Clark Axles, Allison Transmissions!
3. **LEAST VENTILATION** required underground due to low horsepower ratio to work-done!
4. **LOWEST LABOR COST PER TON!** Incentive systems fit the S-D Transloader like a glove because of solo operation! Nothing could be neater than an operator loading and running a known distance to discharge **by himself!** This RELEASES SUPERVISION! S-D Transloader also ELIMINATES TASK OF TRYING TO BALANCE MEN AND EQUIPMENT WITH CONSTANTLY CHANGING SITUATIONS!

Write us today for Complete Packet of illustrated literature, data and time studies on this remarkable machine —

THE ONLY SELF-LOADING TRANSPORT! Sanford-Day Iron Works, Inc., Dale Avenue, Knoxville, Tennessee. Telephone: 3-4191

SANFORD-DAY

KNOXVILLE, TENNESSEE

ENGINEER'S FIELD REPORT

PRODUCT **CHEVRON PRESSURE PRIMER SYSTEM**

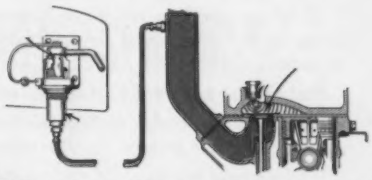
FIRM **JONES-TOMKINS CO.** Cougar, Washington

Special cartridge fires giant diesel in seconds

At world's highest earth-filled dam construction site near Woodland, Washington, three giant diesel shovels get immediate starts from Chevron Pressure Primer System, reports Jones-Tomkins, general contractors. System helps speed shovel's fill-borrowing operations for this $51,000,000 project. Five-year-old 4500 Manitowoc Speed Crane (above), powered by Caterpillar 350 h.p. V-12 D397 engine, operates 18 hours a day, six days a week, loading 21-yard dump trucks in just 70 seconds. Jones-Tomkins uses Standard fuels and lubricants exclusively on this job.

Chevron Pressure Primer Discharger mounted on instrument panel (left) operates satisfactorily despite heavy vibration, reports shovel foreman Henry Watson (right). "We've had absolutely no trouble with this system. The Chevron Pressure Primer System eliminates dust clogging and allows fluid to reach the cylinders quickly. It's the practical way we've found to get these rigs going."

Why Chevron Pressure Primer System assures fast starts



- Volatile Chevron Priming Fuel atomizes in induction system at all temperatures even at -65°F, no hand-pumping required.
- Pressure or weakest spark from engine fires mixture.
- Simple rugged air-tight discharger prevents Priming Fuel leakage.
- Small, fireproof, pressurized steel cartridges protect Priming Fuel from water and dirt.

For More Information or the name of your nearest distributor, write or call any of the companies listed.

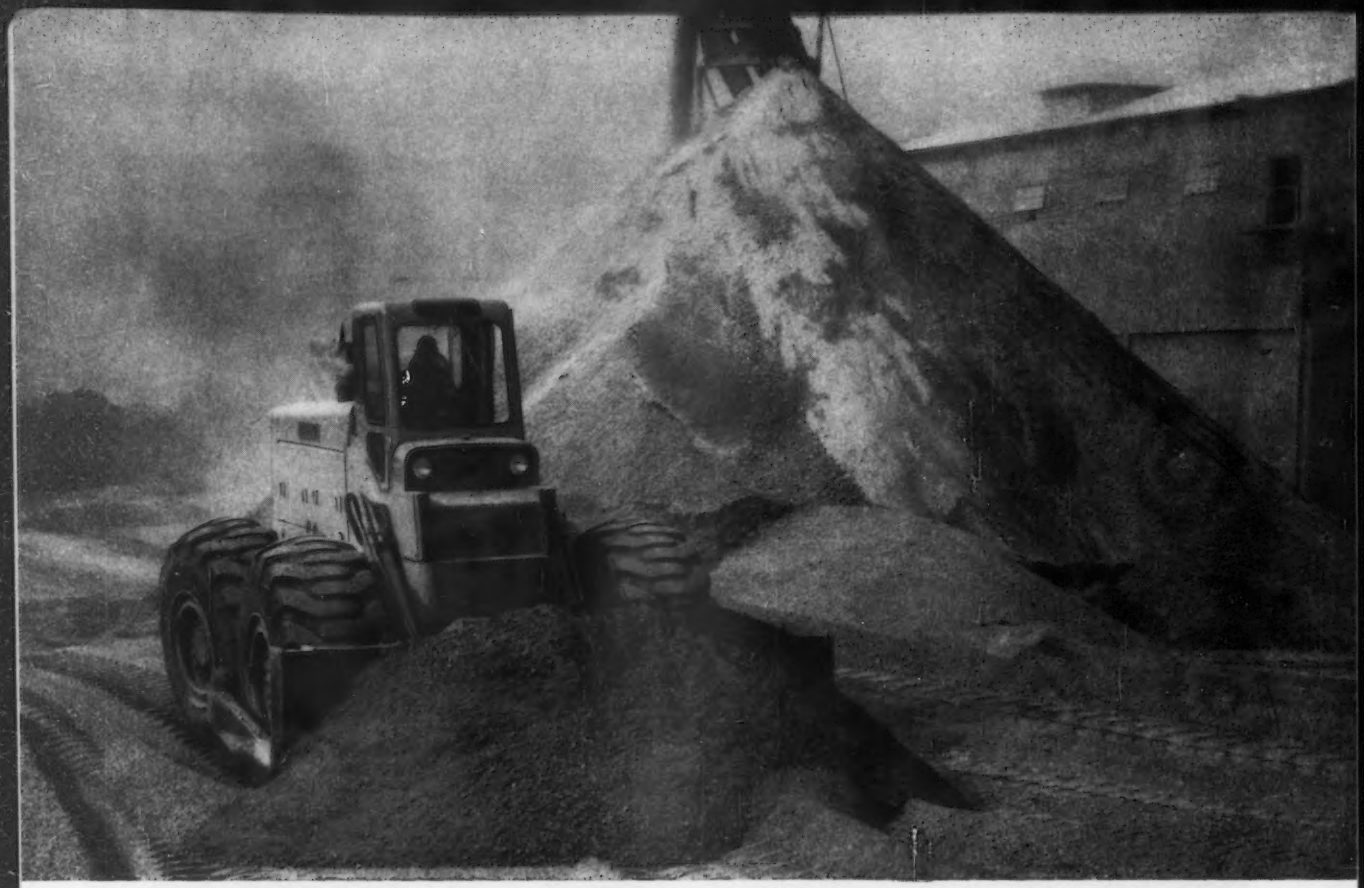
CHEVRON

TRADEMARKS "CHEVRON" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas



Major Southern quarry chooses Michigan Tractor Dozer for top-production job

375 hp model feeds 550 tons hourly to pug mill

At its top rate, this Michigan Tractor Dozer moves 550 tons of crushed stone an hour!

Pushes, one-way, range up to 150 feet.

Same unit also cleans spillage around two rock shovels located ½ mile away.

It alone does the work of two 50,000 lb class crawler dozers.

Owner: Lambert Brothers Division of Vulcan Materials

The Dozer is a 375 hp, 74,000 lb Model 380 Michigan. It is owned by Lambert Brothers Division of Vulcan Materials Inc, Birmingham, Alabama, one of the nation's largest stone producers. The Lambert Division alone operates 25 quarries in Tennessee, North Carolina, Kentucky, and Virginia—most of them Michigan-equipped—they are using this Dozer in their 80 acre pit near Nashville.

The story starts last summer. Harold and Glen Lambert had just installed the pug mill and needed something to feed it. Their existing crawler dozer wouldn't do; it obviously didn't have the mobility to do both pit cleanup and mill feeding. Another big *crawler* would be needed, it seemed. Then Nashville distributor McCarthy, Jones & Woodward suggested a rubber-tired Michigan Tractor Dozer. One was tried. The problem was solved. From four available sizes, a 375 hp model was chosen as best suited to the need (the other size Michigan Tractor Dozers: 162, 262, 600 hp).

Main jobs: feed mill, clean around shovels

The 375 hp machine has been busy ever since.

Most of the time it works at the pug mill—dozing out into a stockpile from the feeder belt when the mill isn't running—feeding when the mill is running at a higher rate than available plant production.

Four to eight times a day, the 25 mph Michigan leaves the mill and drives down blacktopped roads to the quarry for shovel cleanup. Unit makes the ½ mi trip, which took crawlers 20 minutes or so one-way, in 2 to 3 minutes.

50% cut in shovel cleanup time

In the pit, the Michigan saves more time (and money). Back in Lambert Brothers crawler days, a good operator could clean the spillage around one shovel in 5 or 6 minutes. Today, their high-speed Michigan does each cleanup in 2 to 3 minutes.

Sound worthwhile for *your* job? Why not check first-hand? Drop us a line—or call—we'll show you a Michigan Tractor Dozer in action so you can judge its advantages for yourself.

Michigan is a registered trademark of

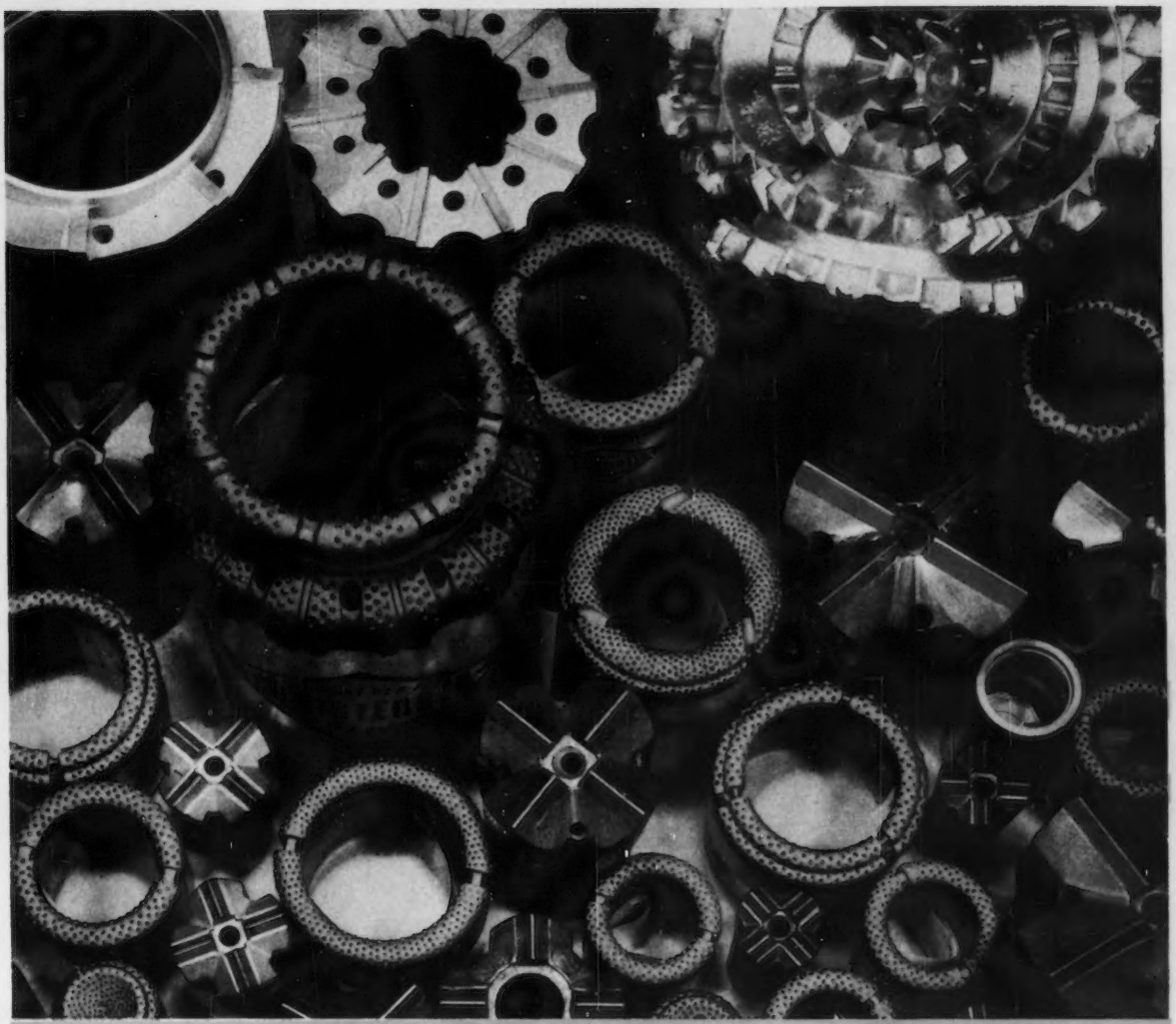
CLARK EQUIPMENT COMPANY

Construction Machinery Division

CLARK® EQUIPMENT

2465 Pipestone Road
Benton Harbor 18, Michigan

In Canada:
Canadian Clark Ltd.
St. Thomas, Ontario



If your problem is making hole . . .

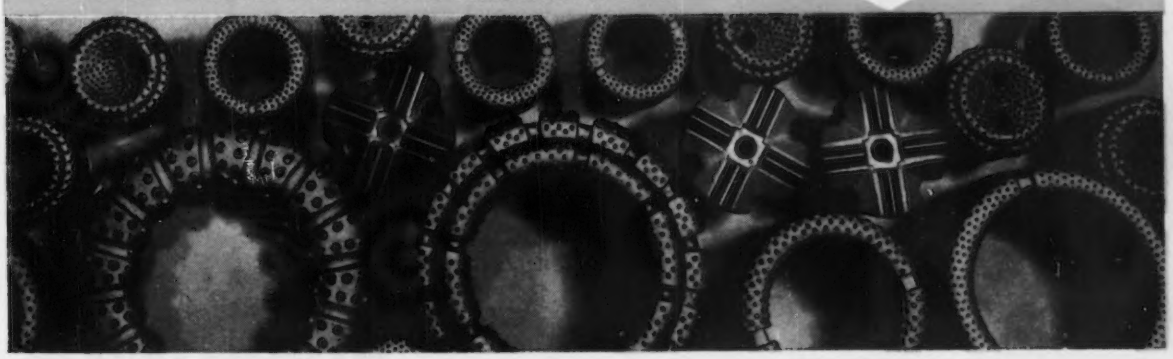
. . . Christensen offers a complete line of diamond bits, reaming shells, and core barrels. Also available are tungsten carbide and roller cone bits. When you need "complete" custom bit service, contact Christensen.

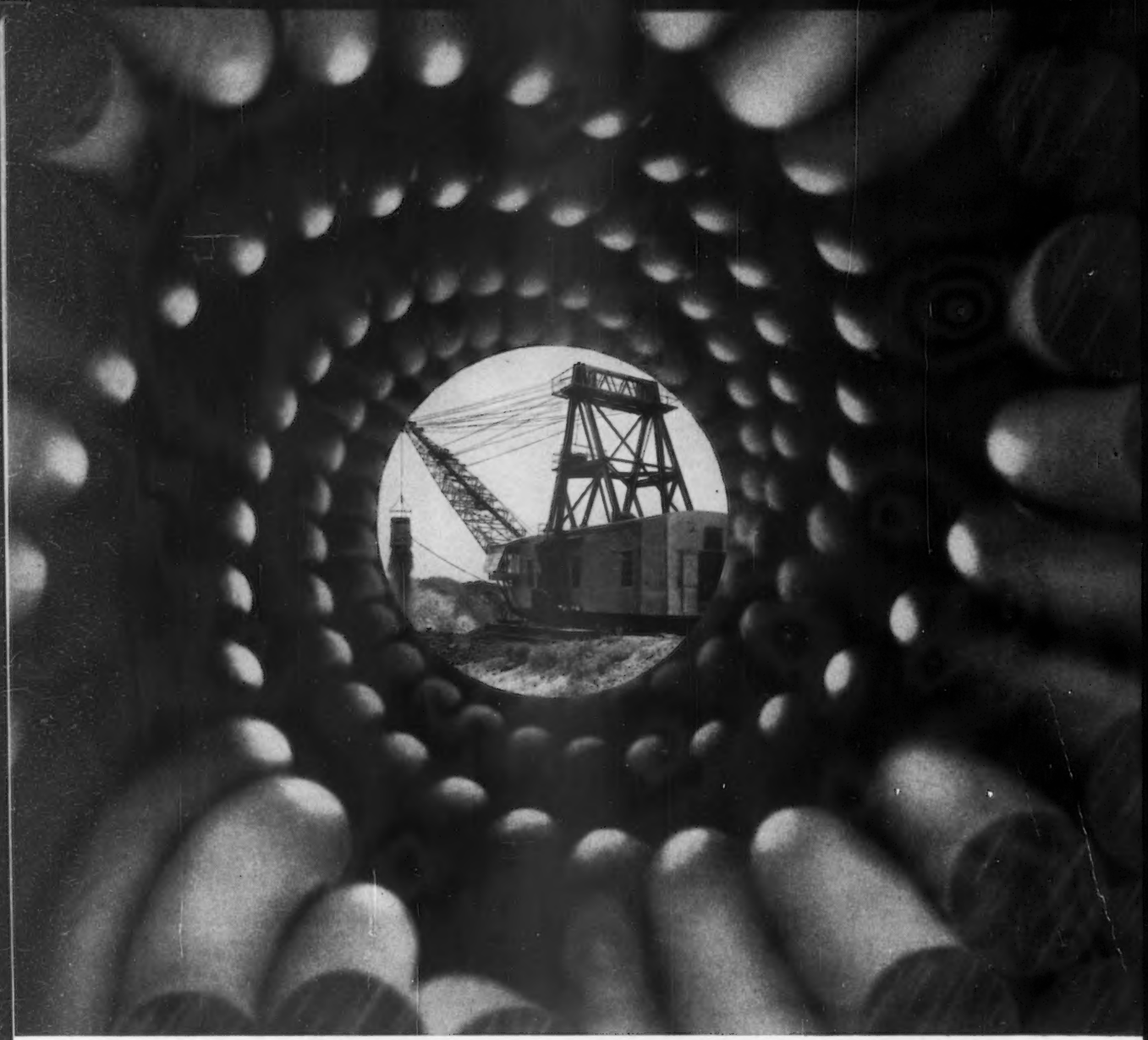
"Less cost per foot"

CHRISTENSEN DIAMOND PRODUCTS

MAIN OFFICE AND PLANT 1937 SOUTH 2nd WEST
SALT LAKE CITY, UTAH

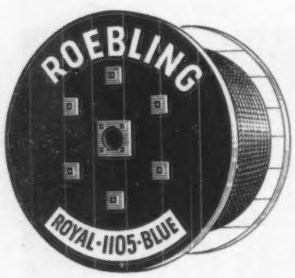
SERVICE FROM WORLD-WIDE SALES OFFICES AND MANUFACTURING PLANTS





ROEBLING ROYAL BLUE WIRE ROPE

WE PUT A LOT OF WORK INTO IT—YOU GET A LOT OF WORK OUT OF IT



This happens to be the inside view of Roebling Royal Blue — its core has been removed to show the uniformity and symmetry of the rope structure. You see how concerned we are with internal security.

We have to be. To make sure that Royal Blue will live up to the day-to-day demands made upon it. High stresses and unavoidable overloads, abrasion, fatigue, impact, crushing, sheave pressures and abusive drum-winding, to name the major ones.

Royal Blue goes through many inspections and tests—both internal and external —before reporting to work. This way we're sure that the rope we build will do what we sell it to do. These quality-control measures are your assurance that Royal Blue is made to save you money — anyway you look at it.

For details about hard-working Royal Blue, ask your wire rope distributor or write Roebling's Wire Rope Division, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities • John A. Roebling's Sons Division • The Colorado Fuel and Iron Corporation

REQUIREMENTS BACKED BY RESEARCH

Creative research is working for you today at Halliburton! In a continuing program of creative research and development, new and better grouting materials and placement techniques have been and are being introduced by Halliburton to make pressure grouting more efficient and more effective than ever before. Halliburton can meet your grouting needs with:

MEN
... in the field – in the laboratory – on the job. Using their extensive knowledge, gained by technical training and sub-surface experience, to help you obtain better results with the most advanced techniques and equipment.

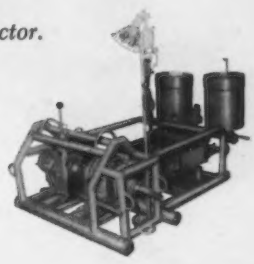
EQUIPMENT
... *job proven* for dependable and convenient metering, mixing and displacement of grouting materials.

MATERIALS
... in the widest selection of chemicals and cements available. *Chemical Grouts* for placement in a single operation – designed for more thorough setting throughout the permeable zones than with chemical-plus-catalyst, two-step methods. *Cement Grouts* designed for continuous placement in connection with consolidation and/or plugging of permeable formations. Admixes, retarders and accelerators are available for helping to provide greater control in setting characteristics and times in various formations.

Call your nearest Halliburton Pressure Grouting Service Division Office and see how this unbeatable MEN-EQUIPMENT-MATERIALS combination ... backed by the most modern research facilities ... can help provide you with *full-scope* service in the field of grouting.

Write today for your copy of the new "Halliburton Pressure Grouting Service" Brochure No. PGS-0002.

Halliburton is financially able to perform any size grouting job as a prime or sub-contractor.



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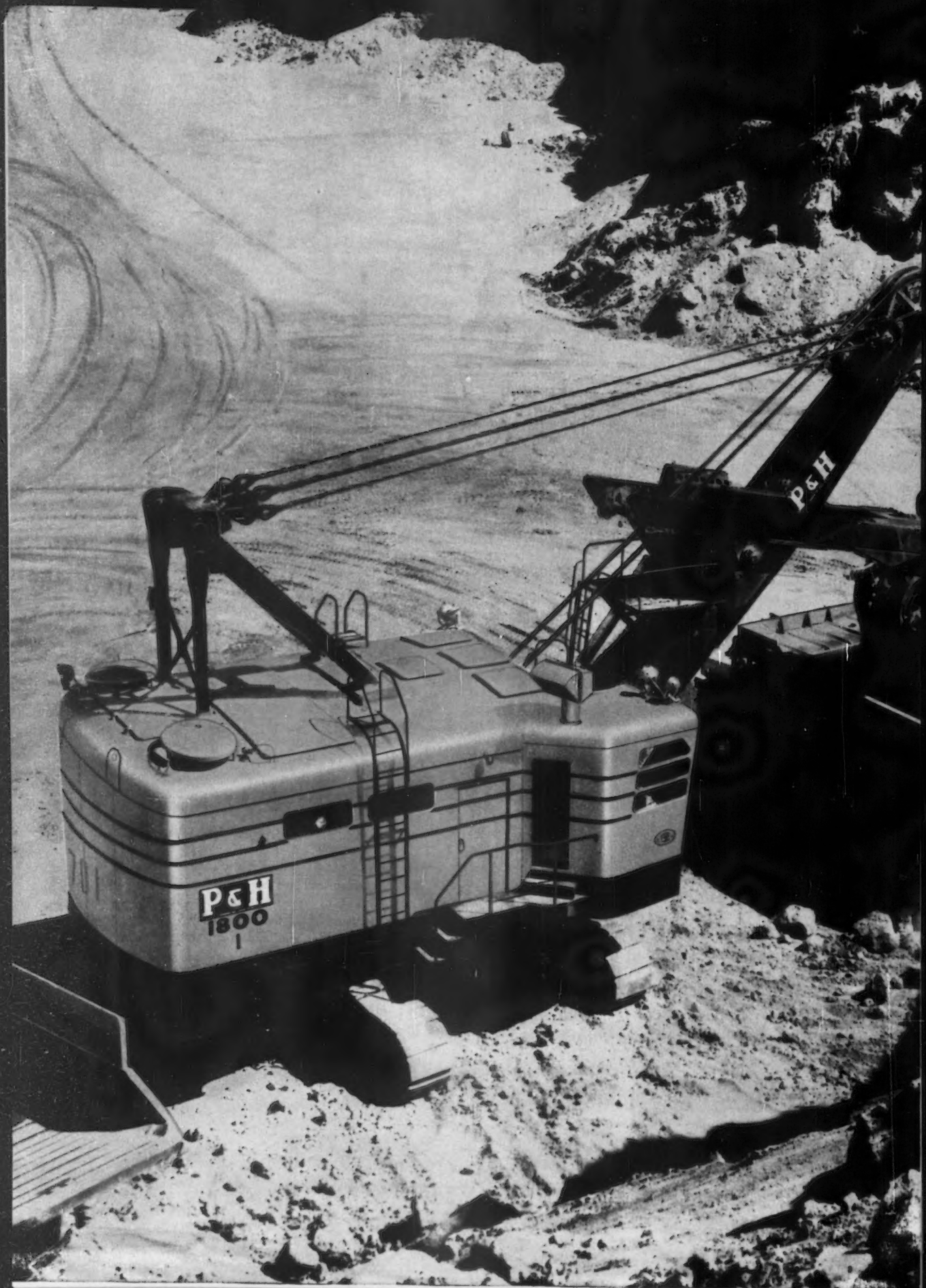
PRESSURE GROUTING SERVICE

A DIVISION OF HALLIBURTON COMPANY • DUNCAN, OKLAHOMA


P&H
P&H
1800

IF PURCHASES ARE ENDORSEMENTS...

P&H is the no. 1 choice in copper mining

Every electric shovel bought for the Southwest by copper companies in the past year has been P&H

Typical of P&H acceptance in copper mining, today you will find *three* or *more* P&H Electric Shovels working at each of 8 out of Arizona's 9 operating copper mines.

P&H has earned such widespread acceptance in the copper mining industry because of lower per-ton loading cost. This profit premium to owners of P&H Electrics results from two basic advantages.

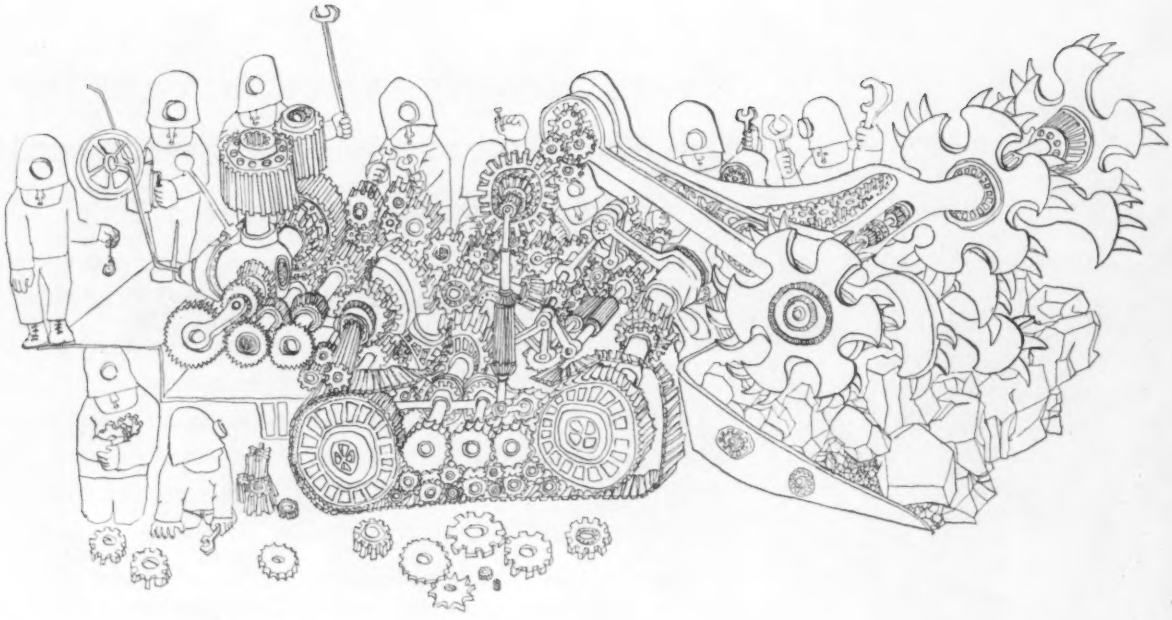
1. Higher rate of production made possible by exclusive, patented P&H design principles: MAGNETORQUE® Hoist Drive and Electronic Control.

2. Vastly superior service and parts availability reflecting our partnership of responsibility to you, the buyers of our products.

Your satisfaction with these advantages has made us the *World's Largest Builder of Full-electric Shovels.*

HARNISCHFEGER P&H
Milwaukee 46, Wisconsin

the digger's dilapidation



(or, How not to be a victim of tired gears)

She was a beauty when they brought her in. Shiny paint. Ferocious teeth that could chew out a whopping 5 tons of coal per minute. A drive that looked like it could rout out a vein from here to Medicine Hat, Montana, and back. At least that's the way it *looked*. Then one day fatigue set in. The old girl had tired gears. There were sounds like skis falling down stairs, a crack of doom and, wham, she stopped right in the middle of a bite. Busted gear.

Gear failure costs money, especially in terms of downtime and lost production. That's why it is essential to use *quality* alloy steel for gears, bearings, shafts and other highly stressed parts. Only the best is good enough when any failure is costly. The care and precision in making USS Alloy Gear Steels are for one purpose: prevention of failure. USS Alloy Gear Steels deliver dimensional stability. They come in a wide range of mechanical properties and processing capabilities.

The Lee-Norse Company's continuous coal miner will never be a victim of tired gears. Alloy steels such as 3310, 4815, 4820, 4320, 4340 and 8620 give its gears, pinions and shafts superb toughness and resistance to impact and wear. These cutter head drive gears are made of 4820, 4320 and 4817 alloy steels.

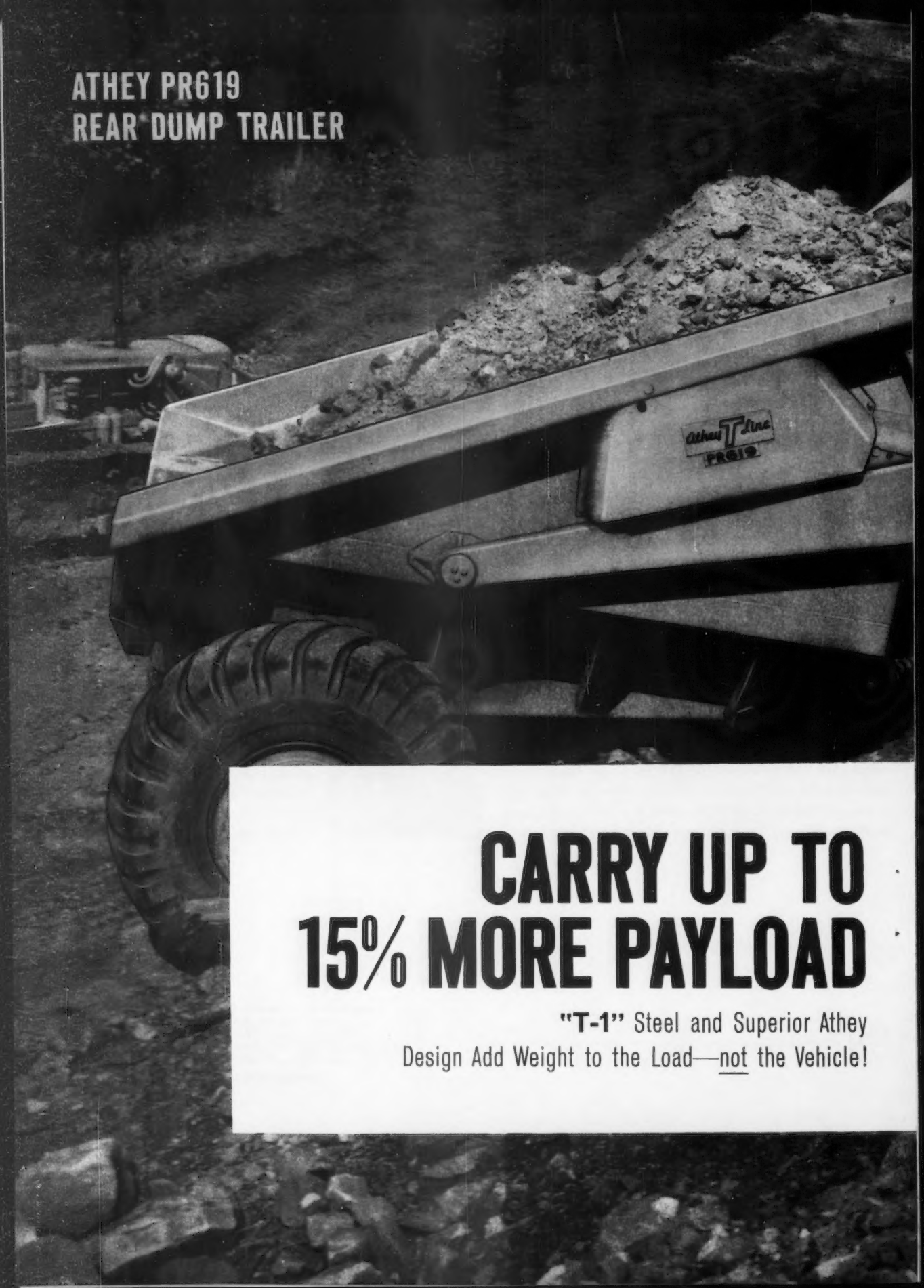
Be sure to specify USS Alloy Gear Steels for *any* of your gear requirements. Carburizing steels for toughness, shock and wear resistance; through-hardening steels for heavy loads at slow and medium speeds; cyaniding and nitriding steels for wear.

For more information and prompt metallurgical assistance, call our nearest sales office or United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS is a registered trademark

This mark tells you a product is made of modern, dependable Steel.

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company
United States Steel



CARRY UP TO 15% MORE PAYLOAD

"T-1" Steel and Superior Athey Design Add Weight to the Load—not the Vehicle!

Big. 25-ton capacity—wide target for fast loading. "T-1" steel permits payloads 2½ times trailer weight.

Nimble. Quickly maneuvers into tightest spots. Clean 12-second dumps. Low CG for safety on uneven footing, ramps, slopes, crossovers.

Fast. Up to 30 mph, and more. Dependable power from husky Caterpillar 619B Tractor. Sure-footed loaded or empty.

Saves You Money. PR619 means the fastest, most economical hauling whatever the service—longer equipment life with less maintenance—lower costs per yard, per ton, per job, per year. There has never been a rear dump trailer like it!

SEE IT AT THE SHOW!

Get all the economy facts first-hand at the Mining Congress Show. Check construction point-by-point. See the PR619 on display. Or, if you're not coming to Las Vegas, your Athey-Caterpillar Dealer will be glad to demonstrate how the PR619 can save you money on at-the-mine hauling.

ATHEY PRODUCTS CORPORATION, 5631 West 65th Street, Chicago 38, Illinois

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GET THE FACTS AT YOUR

Athey

CATERPILLAR
DEALER

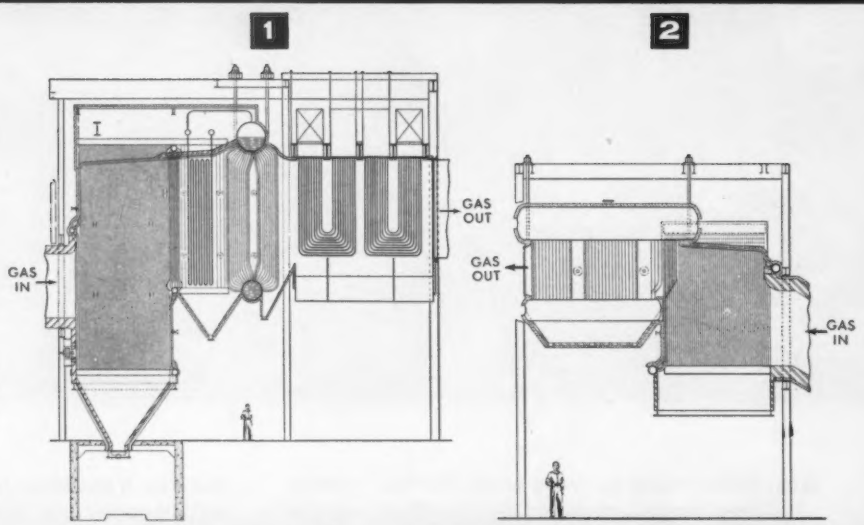
Effective Utilization of Waste Heat in Metallurgical Processing

CUSTOM-ENGINEERED B&W UNITS

Illustrated are 5 B&W Heat-Recovery Units, typical of many currently serving the metallurgical process industries. Complete data on application and modification of these and other units will be found in B&W Bulletin G-88, previously mentioned. Please write for your copy today. Address: The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W WASTE HEAT RECOVERY UNITS FOR

1. Copper Reverberatory Furnaces
2. Refining Furnaces for Copper and other metals
3. Ore Roaster, Acid Plant or Kiln
4. Zinc Fuming Furnaces
5. Heat Recovery with high temperature air heating and corrosion section



CONSIDERATIONS

The economic success of many metallurgical processes requires recovery of valuable heat and entrained product particles in waste gases.

In selecting or designing the best boiler for this important task, the following factors must be considered:

- **Quantity of waste gas**
- **Gas temperature**
- **Gas pressure**
- **Chemical constituents of waste gas**
- **Concentration of metallics and ash in waste gas**
- **Size and abrasive characteristics of entrained material**
- **Fusion temperature of material carried in waste gas**

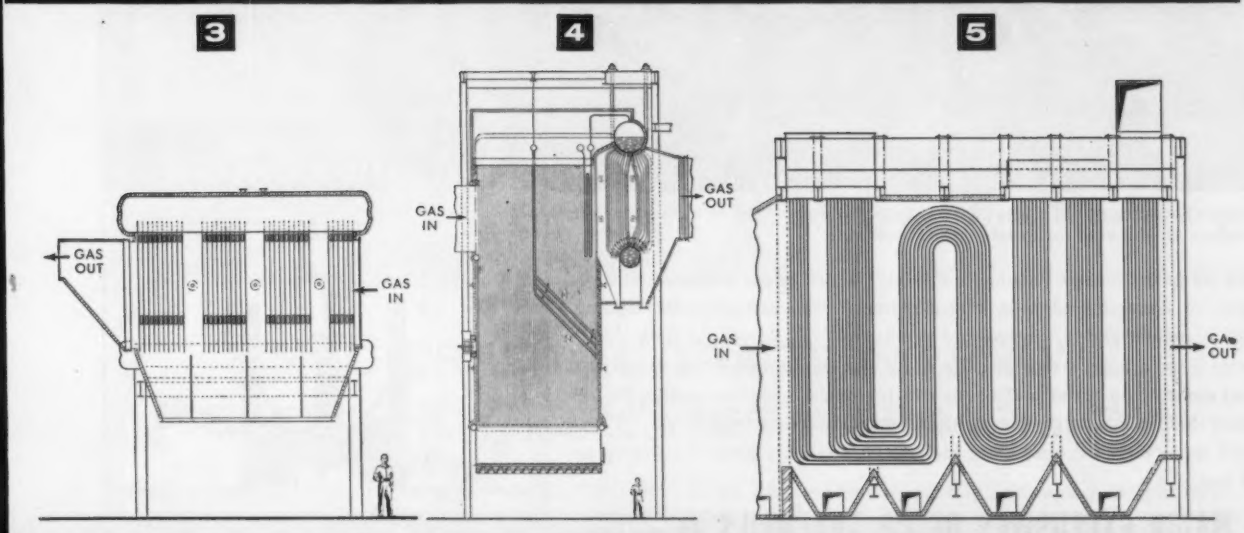
Specific operating requirements further complicate the problem of heat and product-particle recovery. For a complete discussion of Waste-Heat Boilers and their application, write for B&W Bulletin G-88.

B&W DESIGN FEATURES

B&W heat-recovery and boiler-design specialists have years of practical experience in designing units for a wide variety of applications. Custom-engineered to meet specific process requirements, B&W Waste-Heat Boilers incorporate the following outstanding design features:

- Slagging problems are eliminated by cooling waste gases below the ash fusion temperature in water-cooled furnaces.
- Waste gas leakage and acid corrosion are eliminated by providing pressure casing. The casing temperature is maintained above the dew point of corrosive constituents in the gases. This inner casing permits operating up to seven inches w.g. gas pressure.
- Tube erosion by gas-borne material is eliminated and low-draft losses are obtained by designing for low-gas velocities, with no gas baffles in the tube bank.
- In-line tube arrangements used throughout permit efficient tube bank cleaning by soot blowers, or hand lancing when appropriate.
- High-efficiency B&W Cyclone Steam Separators prevent solids carry-over in the steam, thus protect against superheater and turbine fouling difficulties.
- Complete visual observation of all heating surfaces is provided with ample, properly located doors and lance ports.
- Hoppers wth steep sloping sides and large outlet connections prevent material "hang-up."

These built-in features assure continuous, trouble-free operation with low maintenance and high efficiency from every B&W Waste-Heat Boiler.



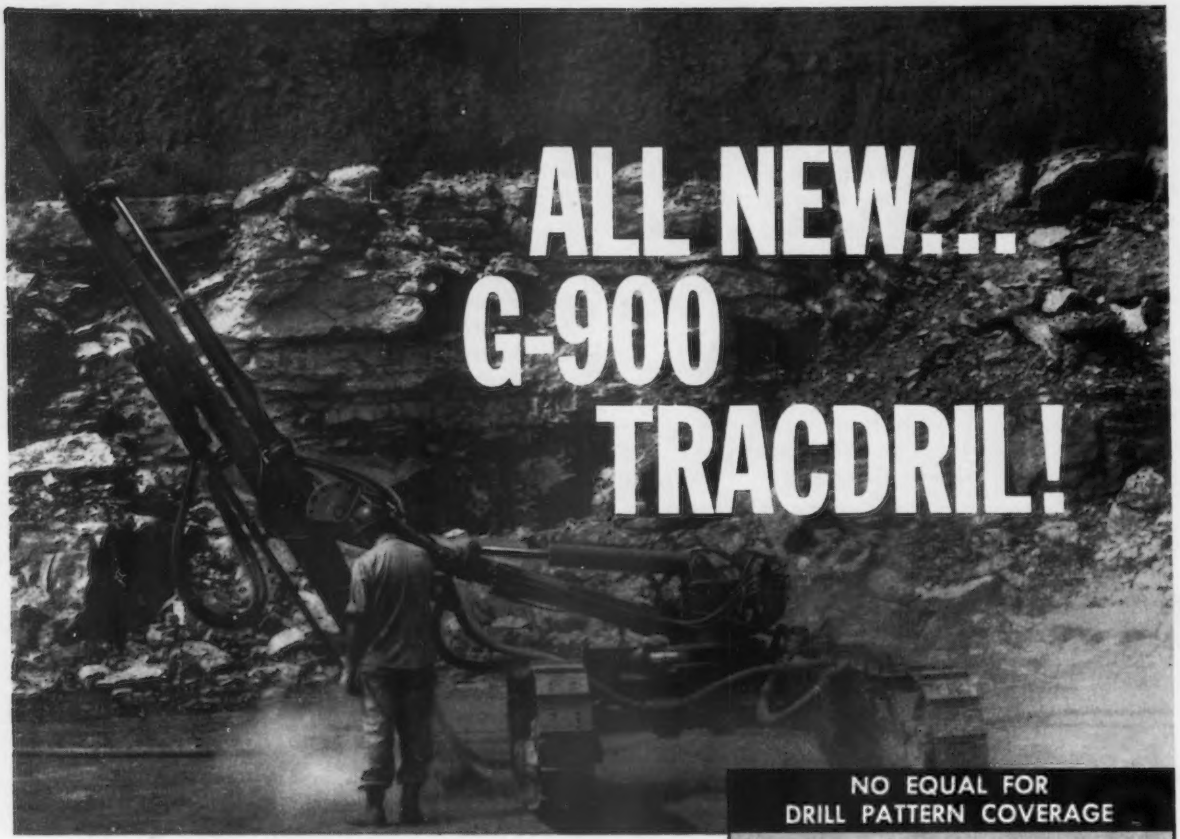
B&W Bulletin G-88
— "Effective Utilization of Waste Heat"
— on request.

ME-101

B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION



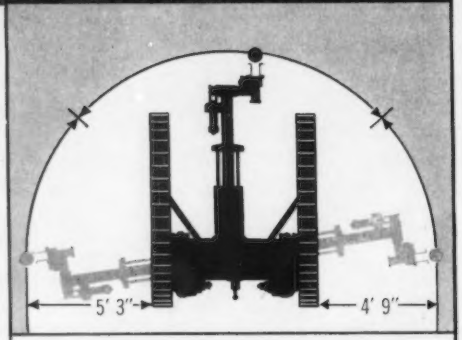
Unmatched versatility . . . drill boom is swung at right angles to tracks and drill carriage tilted inward for steeply sloped conditions.

The all new Chicago Pneumatic G-900 Tracdril is the culmination of 5 years of research and wide field experience. This self-propelled drilling unit is maneuverable, rugged and productive . . . a real *"drillers drill."* Extra large drilling radius because of its 180° horizontal boom swing and dual controls on turret and boom end for quick, accurate positioning of boom and drill carriage give the driller exceptional flexibility.
With the sensational 4½" Deep Hole Drill, it quickly sinks 3" holes up to 75 feet.

6 MAJOR EXCLUSIVES OF CP TRACDRILS

❶ **"Boarding house reach"** lets the drill carriage stretch out 63" beyond tracks to drill true verticals alongside the unit. ❷ **Extra-long Oliver tracks,** specially designed, provide stabilizing ground contact of 1350 square inches. ❸ **Sure-footedness and maximum traction** are assured with five lower track wheels. ❹ **Seven labor-saving hydraulic cylinders** ease driller's muscle work, give fluid-smooth action. ❺ **Two sets of grouped controls,** at turret and boom end, save time and steps for driller, boost footage. ❻ **"Dead man" automatic brakes** that slam on when tramming throttle is closed, locking unit on steepest slopes or bad ground.

NO EQUAL FOR DRILL PATTERN COVERAGE



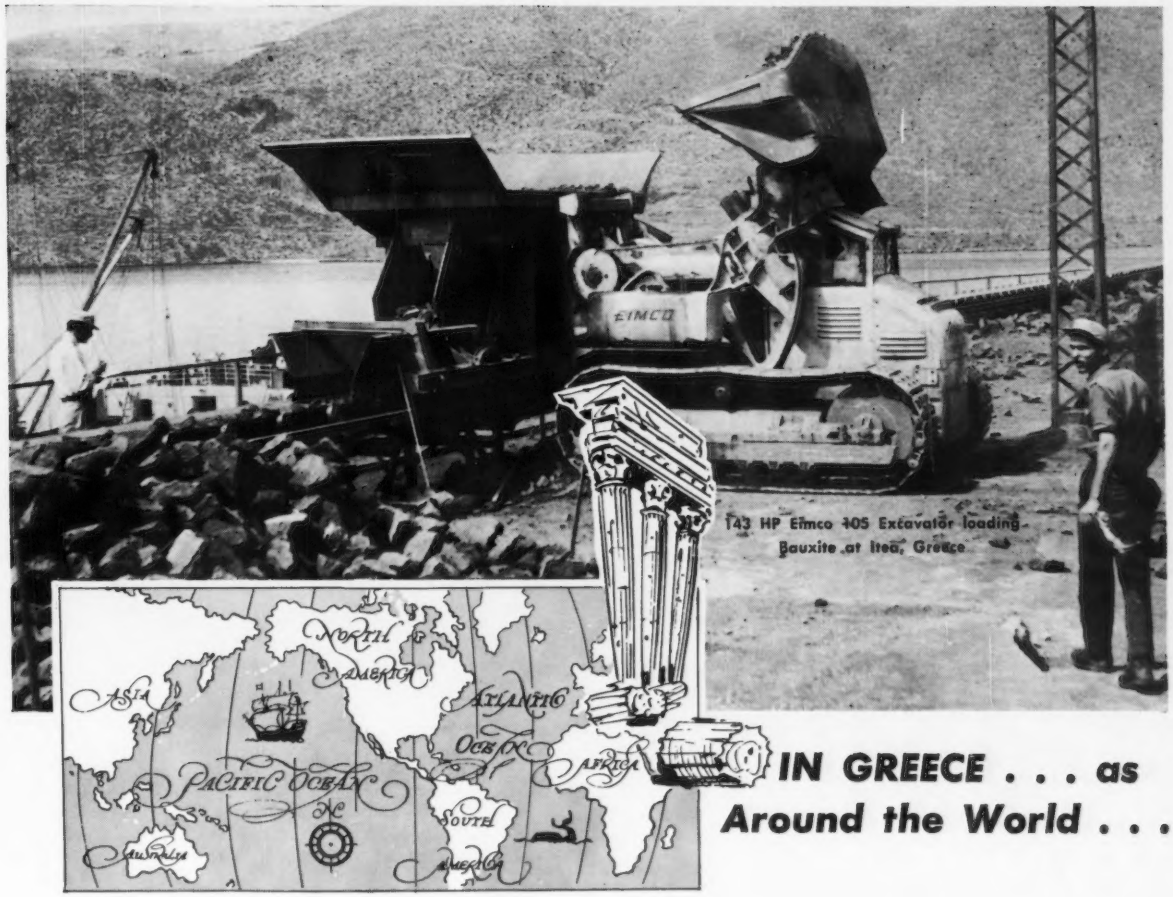
- **Full 180° Ground Coverage . . . right or left. New G-900 drills true verticals at 90° angle to tracks.**

- Reaches "way-up" for extra high horizontal breast holes . . . to 11 feet.
- Big 85° carriage swing compensates for steeply sloped conditions.
- Keeps snake holes "way-down" and properly inclined . . . no interference from feed motors or crawler carriage structural members.

Full specifications and details in Bulletin SP-3627

Chicago Pneumatic 8 East 44th Street, New York 17, N. Y.

AIR COMPRESSORS • PNEUMATIC AND ELECTRIC TOOLS • AIR-BLAST BITS • DIAMOND DRILLS • REICHdrills • ROCK DRILLS



143 HP Eimco 105 Excavator loading Bauxite at Itea, Greece

IN GREECE . . . as Around the World . . .

EIMCO CRAWLER-TRACTORS PROVE EFFICIENCY... GREATER WORKABILITY !

Real savings in time and manpower result from the use of this Eimco 105 Excavator, one of three operated at the Parnasse Bauxite Mines in Itea, Greece.

This Eimco Excavator, with its unique overhead loading action, dumps directly into a specially designed hopper, which distributes the load onto a conveyor, running to the ship's hold. Others are used in mining.

With its great breakout force; up to 55,000 pounds drawbar pull with zero track slippage at sea level; easy finger tip controls and rugged, quality construction, the Eimco Excavator can have many applications on a variety of materials handling jobs . . . the tougher, the better! The Excavator bucket transmission is an independent assembly, operating at a constant speed, with high and low speed ranges, through the rear power take-off and belt drive.

Let a qualified Eimco dealer or sales engineer show you how a modern, efficient Eimco crawler-tractor unit can save you real money and time, with the machine that has established a record of 70% less in parts and maintenance costs than any competitive tractor . . . the quality built and engineered Eimco . . . now available in 100 HP, 143 HP and 205 HP Diesel series of Bulldozers, Excavators, Front End Loaders, Fork Lifts and Log Loaders.

Write The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah, U.S.A.

"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884"

THE EIMCO CORPORATION

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that POWERFUL SELECTIVE AEROFLOAT® PROMOTERS *Achieve Maximum Zinc Recovery*

PLANT	TPD	FEED		% Zn			% RECOVERY	GRIND				
		Gangue	Sulfides	Feed	Conc.	Tails			$CuSO_4$	NaAF	A-211	ABC
A	2000	Limestone, dolomite, chert	ZnS, up to 5% FeS_2, traces PbS	4.0	60.0	0.25	94.2	18.8% + 65 Mesh 32.5% + 100 Mesh 46.8% – 200 Mesh	0.35		0.08	0.10
B	2000	Limestone, dolomite, chert, rare calcite	ZnS, traces of FeS_2	5.5 to 5.75	63.5	0.10	98.4	35.5% + 65 Mesh 48.7% + 100 Mesh 35.7% – 200 Mesh	0.44		0.07	
C	5400 total, 1790 flot.	Dolomite, chert	ZnS, traces of FeS_2 (0.5% Fe)	Flot. 8.08 HMS 3.45	61.95	0.22	96.7 (flot.)	30.9% + 65 Mesh 40.8% + 100 Mesh 41.5% – 200 Mesh	0.860*	0.092*		
D	1550	Dolomite, chert	ZnS, traces of FeS_2	4.59	64.0	0.21	95.7	42.5% + 65 Mesh 53.0% + 100 Mesh 25.5% – 200 Mesh	0.40	0.067		
E	2500	Dolomitic limestone	ZnS, traces of FeS_2	6.4	59.0	0.75	89.5	18% + 100 Mesh 60% – 200 Mesh	1.0		0.17	

*Reagents on basis flot. feed

Here are operating results from five large U.S. zinc mills showing how reagent combinations based on SODIUM AEROFLOAT or AEROFLOAT 211 Promoters produce maximum recovery in a high-grade concentrate.

While these are impressive metallurgical results on relatively simple, easy-to-treat zinc ores, both SODIUM AEROFLOAT and AEROFLOAT 211 Promoters will also do an outstanding job on more complex zinc ores and on lead-zinc ores where maximum recovery at highest grade is desired.

Both SODIUM AEROFLOAT and AEROFLOAT 211 are highly effective promoters for the rapid and high recovery of sphalerite. Both have the added advantage of good selectivity on complex ores. SODIUM AEROFLOAT is widely used to float coarse sphalerite. AEROFLOAT 211 is frequently preferred to float slimed sphalerite.

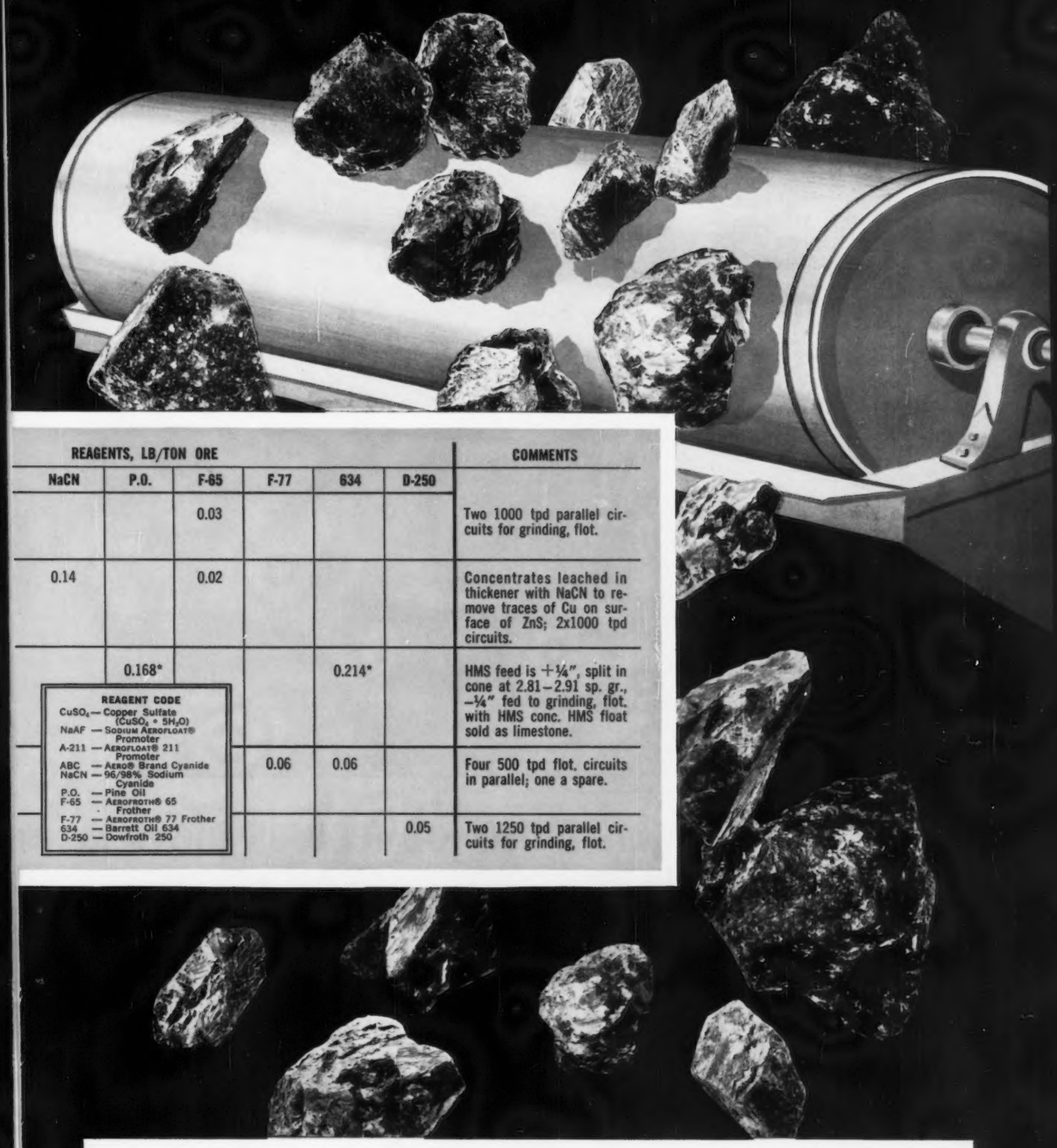
Cyanamid furnishes the most complete line of metallurgical chemicals and has maintained for nearly 45 years an unfailing delivery to every world mining field. Cyanamid Field Engineers backed by the Cyanamid Mining Chemicals Laboratory will be glad to work with you to develop the most effective reagent combination of Cyanamid Reagents for your ore under your operating conditions and economics.

* * * * * *

Your ore-dressing bookshelf should contain these current Cyanamid Mining Chemicals publications:

Flotation Reagents **Cyanamid Flocculants** **Chemistry of Cyanidation**
Handling & Feeding AERO® Brand Cyanide **Color Microscopy for the Mill Man**

Our nearest office will provide copies upon request.



REAGENTS, LB/TON ORE						COMMENTS
NaCN	P.O.	F-65	F-77	634	D-250	
		0.03				Two 1000 tpd parallel circuits for grinding, flot.
0.14		0.02				Concentrates leached in thickener with NaCN to remove traces of Cu on surface of ZnS; 2x1000 tpd circuits.
	0.168*			0.214*		HMS feed is +¼", split in cone at 2.81–2.91 sp. gr., –¼" fed to grinding, flot. with HMS conc. HMS float sold as limestone.
			0.06	0.06		Four 500 tpd flot. circuits in parallel; one a spare.
					0.05	Two 1250 tpd parallel circuits for grinding, flot.

REAGENT CODE

$CuSO_4$ — Copper Sulfate ($CuSO_4 \cdot 5H_2O$)
NaAF — Sodium Aerofloat® Promoter
A-211 — Aerofloat® 211 Promoter
ABC — Aero® Brand Cyanide
NaCN — 96/98% Sodium Cyanide
P.O. — Pine Oil
F-65 — Aerofroth® 65 Frother
F-77 — Aerofroth® 77 Frother
634 — Barrett Oil 634
D-250 — Dowfroth 250

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EXPLOSIVES AND MINING CHEMICALS DEPARTMENT
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Where heavyweights move job records prove...
FIRESTONE STAMINA KEEPS PROJECTS ON SCHEDULE!

That sure-fire stamina of cord and rubber in Firestone off-the-highway tires pays off *big*. These dependable tires keep costly equipment on the go and meet tightest schedules. Such exclusives as Firestone Rubber-X—longest-wearing rubber ever built into Firestone tires—and Firestone Shock-Fortified nylon cord—that takes the most gruelling impact punishment in stride—see to that! Another plus: Firestone's Giant Tire Service stands back of every Firestone tire, and a Firestone Tire Expert will match tires to specific project needs and handle your tire maintenance problems. For more worktime and less downtime, see your Firestone Dealer or Store. Or write: Manager, Off-The-Highway Tires, The Firestone Tire & Rubber Co., Akron, Ohio.

ALWAYS SPECIFY FIRESTONE TIRES WHEN ORDERING NEW EQUIPMENT

Super Rock Grip Wide Base* Super Rock Grip Deep Tread*

TUBELESS OR TUBED

Firestone

BETTER RUBBER FROM START TO FINISH

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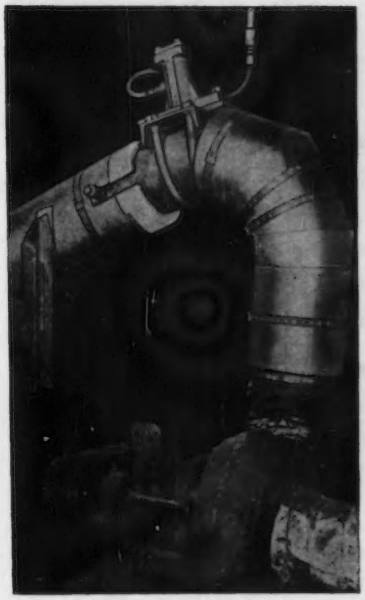
NEW PRODUCTS DIGEST



Pipe Vibrator (3)

NATIONAL AIR VIBRATOR CO. has developed a new pneumatic impacting vibrator that keeps moist material moving through all types of piping arrangements. According to the company, powdered coal, ores and flyash are dislodged by the timed impact of its BH-2 SP Air Vibrator, not "packed" by the high-frequency vibration characteristic of conventional vibrators.

National Air went on to say that BH-2 has a patented one-piece design that eliminates body assembly bolts—cuts vibrator maintenance downtime.

Compact, Efficient Primers (16)

THREE COMPACT PRIMERS, two of which are no larger than a man's palm, yet are equivalent to the regular 30-lb dynamite primers, have been developed by Austin Powder Co.

Primers are designated Austin Red Cap, Blue Cap and Black Cap, and are said to be unaffected by water and completely insensitive to shock and abrasion, with rifle impact sensitivity of zero. As a result, Austin said, holes can be loaded as soon as drilled, when primers are used with detonating fuse. If incomplete detonation should occur because of improper connections, primers can be more safely dug out.

All three primers are made of special-cast high explosive, and have a speed of

more than 22,000 fps. Red and Black Caps, those equivalent to regular 30-lb dynamite primers, are designed for initiating a minimum of 300 lb of low-grade ammonium nitrate in large-dia. holes. The eight-oz Blue Cap is for small-dia. holes.

Austin said that all three are furnished with a central channel—permitting fast threading of detonating fuse through their entire length.

Micro Grain Analyzer (1)

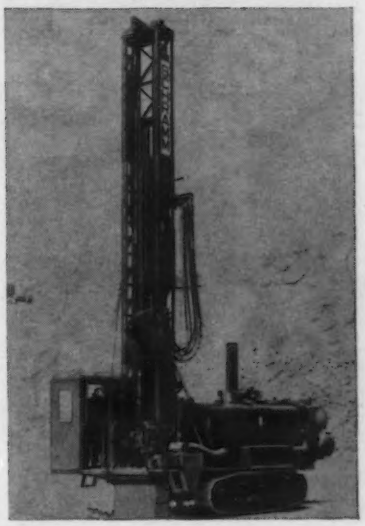
AN ANALYZING INSTRUMENT, called the Micrographix Comparator, which gets a rapid determination of grain size in copper and copper-base alloys, has been developed by General Scientific Equipment Co.

The firm said that its compact mill and laboratory instrument features an external reflecting element incorporated into the housing to assure proper alignment of the microscope, and a large 4x3¼-in. ground-glass screen.

Grain size is determined by first mounting the specimen on the microscope stage, then rotating the standard micrographs, which are turret-mounted on either side of the viewing screen. Twelve ASTM Standard micrographs represent sizes of .015 to 2.00 and identify a specimen as being between or the same as the standards.

Correction

IN THE SEPTEMBER New Products Digest, on page 53, item 9 referred to an igniter tester made by Kinematics Corp. The correct firm name is Kinetics Corp.



Drill Rig (11)

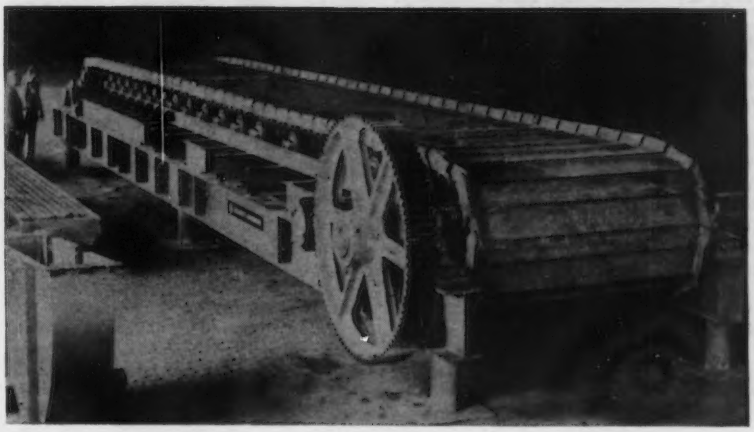
SCHRAMM INC. is introducing a completely self-contained blast-hole drilling rig. The company calls it the Model C66 Crawler ROTADRILL. It mounts on a single self-propelled crawler all equipment necessary for drilling holes to depths needed in quarry and rock-removal operations.

The firm went on to say that the rig is designed for one-man operation—all controls for drilling and maneuvering are

Largest Pan Feeder (20)

ONE OF THE LARGEST PAN FEEDERS ever built (90 in. wide, 45 ft long, and total wt of 165,000 lb) has been finished by Taylor-Wharton Co. on an order from Hewitt-Robins' Robins Engineering Div.

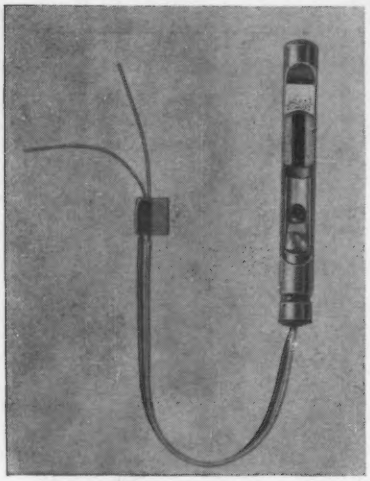
Hewitt-Robins will use the manganese feeder at its primary crusher station, in Chile. The station, Cia Sal Itera de Tarapaca y Antofogasta, Oficiana Victoria, delivers copper ore, which the feeder will receive in chunks up to 1½ tons.

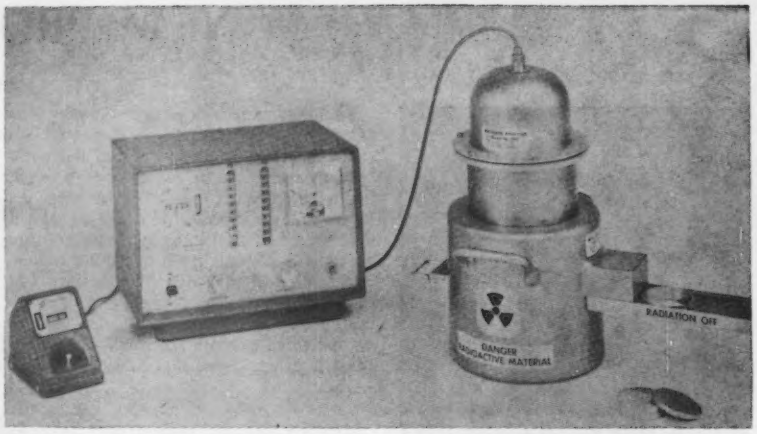


conveniently located in the operator's cab on the work platform.

C66's wide track spread gives excellent stability in rough terrain, Schramm said, and the time-saving advantage of being able to move from hole to hole under most conditions with the mast in the vertical drilling position.

According to Schramm, one great advantage of the C66 is that it is not necessary to transport any additional equipment, when moving the rig from one site to another. The entire unit can be carried on a low-bed trailer, and removal of the mast, or other dismantling, is not required.





Another Counter to Spot Beryllium in Field (21)

BOULDER SCIENTIFIC CO. has come up with a new beryllium analyzer, the Model 200, that can perform accurate analyses in a matter of minutes.

Gamma rays from the Antimony 124 source at the base of the detector bombard a specimen of beryllium, and cause ejection of neutrons. These ejected neutrons are moderated and then detected with a 5-in.-dia, Boron 10 loaded, ZnS scintillation phosphor. The light scintillations are converted to electrical impulses, which are counted by a scaler. By comparison with the count rate from a known sample, the beryllium in an unknown sample can be determined.

Boulder Scientific went on to say that their analyzer contains the following features: Accuracy of 0.02% by weight; analyzing a sample within 3 to 5 min; radiation dose rate at one ft from the analyzer is less than 5 milliroentgens per hr—no need to operate the analyzer in a restricted area; and low operating cost. The radioactive source will maintain enough activity to be used for about six months. Daily cost for the source is only about 70c.

Improved Delay Blasting (31)

NEW SERIES OF ROCKMASTER delay electric blasting caps, with a choice of up to 38 millisecond delay periods for a single blast, has been developed by Atlas Powder Co. The result, according to Atlas, is that bigger, more productive blasts are possible in restricted areas.

Extended Rockmaster provides increased flexibility for millisecond delay blasting—where regulations limit the amount of explosives per delay period, more rock can be shot in a single blast.

Other Rockmaster advantages include:
. . fewer shots needed to maintain production schedules.
. . drilling and earthmoving equipment can work longer and more efficiently.
. . downtime per working day is considerably reduced.

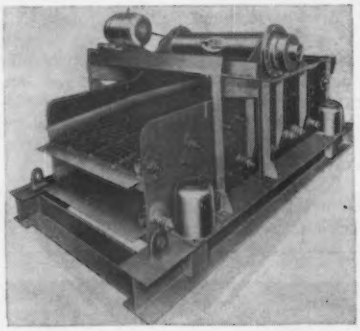
New Screen Suspension (2)

DEISTER MACHINE CO. has announced an improved spring and rubber mount suspension for its vibrating screens which, because of a heavy welded H-beam base, offers far greater stability than older models.

The old suspension system featured a row of heavy steel springs between the angle iron base and the bottom edge of the side plate. The number of springs varied according to the length of the screen, with as many as 16 along either side of an 18-ft unit.

According to Deister, in the new fully-enclosed spring and rubber system, only four mounts are used, one at each corner of the base.

For ease in adjustment or replacement, springs are now conveniently located



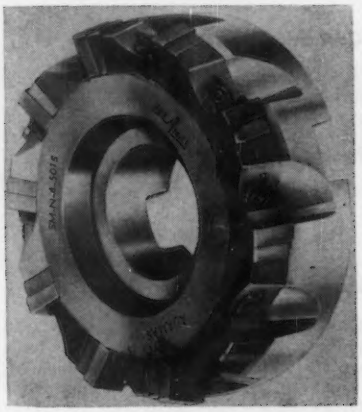
outside the side plates, and can be reached by simply removing the cast covers. Adjustments are made by tightening or loosening one nut and lock nut.

Surface Mender (15)

PERMANENT EXTERIOR PAVING patching material, which is applied in seconds and is reported to be more permanent than the original pavement itself, has been developed by Revere Chemical Corp.

Called Sta-Fil, the new material is recommended for patching chuck-holes, ruts and various other types of deep holes in concrete, asphalt, brick, stone and cinders, caused by expansion cracks or pavement upheavals and enlarged by moving traffic.

The material is ready-to-use (no mixing, heating or priming) and can be applied cold at any temperature and during any weather conditions.



Milling Cutters (14)

ADAMAS CARBIDE CORP. is offering a new line of DEX-A-MILL face and shell end milling cutters, which it claims was especially developed to extend carbide insert life, remove more metal per cutting edge, and produce exceptionally fine finishes.

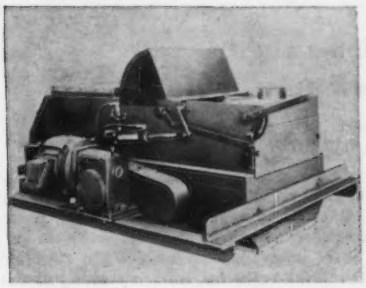
Long-Boom Dragline (29)

HUGE WALKING DRAGLINE, the Model 1250-W, with a unique design to allow it to use boom lengths previously considered impractical, is being marketed by Bucyrus-Erie Co.

The 1250-W is the largest B-E machine of its type; it can handle a 225-ft boom to drag a 35-cu-yd-capacity bucket, and strip overburden to depths of 130 ft.

According to the company, DEX-A-MILL's greater number of teeth assure fast, low-cost milling operations with inexpensive, indexable, throw-away carbide inserts. The inserts are easily locked, unlocked, indexed, or replaced on the machine with the cutter in place. Eight individual cutting edges on each insert eliminate costly regrinding.

Some of the Adamas carbide products incorporated on the new cutters include carbide chip deflectors, carbide anvils, and throw-away carbide inserts.



Odd-Materials Feeder (4)

THAYER SCALE CORP. is introducing an improved conveyor feeder, Series C, which is designed to feed more accurately hard-to-handle material (flaked, fibrous and similar materials ranging up to 1½ in. in dia).

Series C feeders are two-speed single conveyor belt units, with two control gates to regulate feed flow rate. The first, a metering gate, controls the bulk material being fed to the belt. The second, a dribble control gate suspended above the belt, controls the material flow from the belt to containers.

Thayer said that the units are available in two models, and handle up to 80 cfm, operating at 50% efficiency.

Ultra-Simple Beryllium Detector (12)

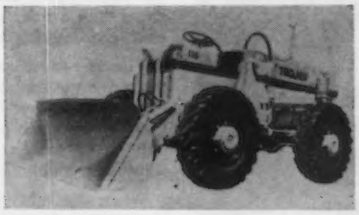
MCGRAW-HILL WORLD NEWS BUREAU reports that Minerals Engineers, Salt Lake City, have put together a "poor man's beryllium prospector's kit."

Minerals Engineers' principals (R. R. Porter, S. S. Arentz, S. S. Alderman and J. O. Horton) say their kit is based on an eight-step chemical - ultra-violet-light procedure developed by the U.S. Bureau of Mines in identifying and rough-assaying beryllium ores and minerals.

Mr. Porter says that "anyone who can fry an egg can use the handy, portable kit." The promoters claim the kit will enable a prospector to do field assaying and identification of beryllium ores running as low as 0.1% beryllium oxide.

CONNELLSVILLE MFG. & MINE SUPPLY CO. recently changed its name and will now be known as Connellsville Corp.

Russell L. Lepley, executive vice-president and general manager of the company, said that since its equipment is known throughout the mining industry, both in the U.S. and overseas, as "Connellsville" equipment, the name change would not require major reorientation of the company's entire marketing program.



Trojan Tractor Shovel (19)

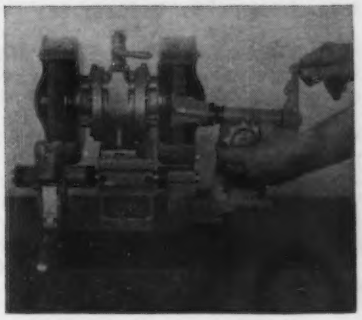
YALE & TOWNE MFG. CO.'s Trojan Div. has announced an addition to its Trojan line of wheeled shovels—one with 6,500-lb lifting capacity and bucket sizes from 1 to 1⅞ cu yd.

Some of the features of the 13,000-lb machine are: power-shift transmission; planetary axles; power steering; and vacuum-boosted hydraulic power brakes. Road speeds of over 25 mph, Trojan said, permit fast, easy moves from one job to another.

Rock Bit Grinder (10)

BITCO INC. HAS INTRODUCED a new version of its pneumatic rock bit grinder which includes heavier bearings, improved exhaust location and streamlined guards.

The manufacturer rates the new unit's performance the same as its ¾-hp heavy-duty electric model. The grinder can be operated by any standard com-



pressor unit, and the pneumatic motor provides a wide speed variation.

The grinder is designed for use with most Bitco standard bit-grinding fixtures and accessories. It is also designed to save time and costs—bits can be dressed at the drill site.

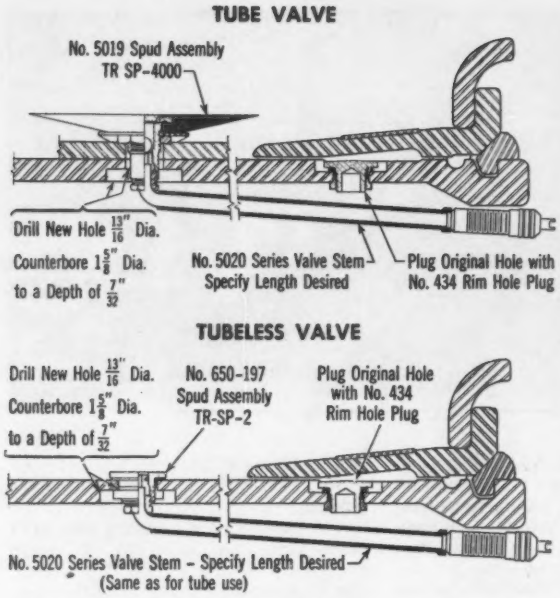
A NEW SINGLE-STAGE compressor bulletin (P-13) published by Elliott Co. features a six-step performance-calculation method which permits selection of the proper compressor for most applications. **(90)**

Heavy-Duty Transmission (54)

HEAVY-DUTY TRANSMISSION, containing a new, three-element torque-converter said to have the highest capacity of any 17-in. unit now in service, is being introduced by the GM Allison Div.

The converter (TC-590) which has a stall torque ratio of 2.5:1, is part of Allison's new CLBT-590 TORQMATIC transmission designed for diesels up to 525 gross hp. Earlier transmissions in the same higher hp series featured four speeds forward with two in reverse. However, Allison reports, CLBT-590 has a "split range" automatic valve body that provides 12 phases to shifting of the transmission.

As an additional feature, the CLBT-590 is available for scrapers without the automatic features of low range.

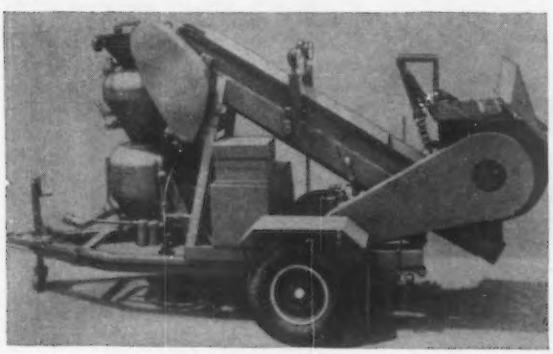


Interchangeable Valves (18)

A. SCHRADER'S SON, Div. of Scovill Mfg. Co., has developed interchangeable large-bore valves that now make it possible for off-highway vehicles to use tube or tubeless tires.

According to a recent announcement from Schrader, the new valve extension assemblies fit both the tube and the tubeless tire valve spuds—interchange between tube and tubeless can be made with only one rim alteration. In converting to tube tires, the original tubeless valve hole is sealed with a Schrader rim hole plug, and a new hole is counterbored and drilled on or near the rim base center to install the new tube valve spud.

The Schrader extension assemblies are available in lengths ranging from 2½ to 30 in.



Guniting at Work Face (13)

MINE AND TUNNEL CREWS can now roll a compact new guniting plant right into underground work areas and shoot their own concrete into place at the rate of 6 to 12 tph, according to Ridley & Co. Inc.

The 6-ft-high rig eliminates the need for the majority of normal roof bolting and timbering—it stabilizes the ground and reduces water and air slackening.

Ridley's Model C-3 UG may be mounted on a mine car, skids, or pneumatic tires, and the entire rig may be knocked down to pass through shafts and narrow openings, and reassembled at the job site.

Basic components include a paddle-type mixer, an elevator, a Ridley concrete gun, and a 100-ft guniting hose complete with nozzle. All operating parts are driven by air motors, powered by mine air lines.

Lime-Cement Unloader (17)

BY USING THE COMPACT, trailer-mounted Ripco Air Caddy, one man can now effortlessly and cleanly unload lime or cement from 75-ton hopper cars.

The manufacturer, Ripco Air Systems, said that the hopper car attachment fits under the car without the necessity of a pit. The material is then drawn by vacuum to the Air Caddy and then sent by air pressure to the storage bin. (In photo, the cement is being pushed a total of 120 ft to the overhead storage bin.)

According to the company, the Air Caddy is a complete unit, gasoline or electrically operated, and mounted on a heavily constructed trailer frame. Any vehicle with trailer hitch, Ripco said, can easily move the unit to widely scattered work areas.

Nothing But Flame Light Can Trigger New Tube (40)

THE U-V DETECTOR, a new electronic tube developed by McGraw-Edison Co., may prove to be a versatile and cheap fire-watchman.

By reacting to ultraviolet radiation, such as is emitted by flames, the tube can tell instantly when a fire has started, or when a flame that is supposed to be burning has gone out. At the same time, since it is insensitive to visible-light rays, it can be used near electric light bulbs, or in direct sunlight, or near glowing firebricks, without giving false alarms.

The gas-filled tube's heart is its pair of specially surface-treated tungsten electrodes which react to ultraviolet light—only in the wave-length range of 1,900 to 2,900 angstroms. Licking the problem of sensitivity—making the tube sensitive only to ultraviolet and not to extraneous rays—was the main stumbling block to its development.

When the tube goes into quantity production, the company expects to sell it in the range of $10 to $20.

Physically, it is about golf-ball size and rugged—operative over an ambient temperature range of minus 75°F to plus 400°F. It responds to, or "sees", ultraviolet light impinging directly on its electrodes, and has a "field of vision" of about a hemisphere. Because it has a high output, it can operate electro-mechanical relays without amplification. Its associated circuitry, which is simple, can be adjusted to vary the over-all sensitivity of the system. Thus, in a mine, where any fire is dangerous, the sensitivity can be set high; while in an airplane, where a false alarm can be as harmful as a fire, it can be set lower. It operates on an ac, or rectified ac, voltage of about 700 v, at a frequency between 25 cps and 100 kc.

According to McGraw-Edison, the 1⅛ x 1¼-in. U-V Detector (including mounting pins which fit an ordinary radio-tube socket), has other applications than that of fire detection. It can be used as a communications device (ship to ship or man to man signaling), as a smoke detector (in warehouses, ventilating ducts, boiler and furnace stacks), and as an electrical arc detector (generators, motors, switchgear, welding controls, etc.).

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

HOW NOISE REDUCTION can increase efficiency and productivity is described in a new 12-page catalog, "Sound Control," from the Allied Witan Co.

The catalog shows typical sound control applications with graphs of noise reduction in decibels, and reduction of noise distinguished by the human ear. **(92)**

NEW 28-PAGE CATALOG on liquid relief and special service safety-relief valves has been published by Farris Engineering Corp.

The catalog contains sizing information, capacity tables, weights and dimensions of a new series of compact safety-relief valves. In addition, it gives brief descriptions of all other Farris products (flexible valves, hydraulic and pneumatic test equipment, steam traps, etc.). **(93)**

THEW SHOVEL CO.'S new 60-ton Lorain Moto-Crane Model MC-760 is fully described in its new 3-color, 12-page booklet.

Thew puts particular emphasis on Lorain's exclusive "Power-Set" outriggers that set up in about one minute. They have special curved beams, with attached self-adjusting floats that move out and down simultaneously. Each beam is individually hydraulically controlled. **(94)**

LARGEST of Caterpillar's wheel Traxcavator line, the 966, is discussed in a 12-page booklet.

The company said that booklet stresses design and engineering features that contribute to the new unit's quick-response performance, versatility, and operator safety and convenience. **(95)**

NEW PLASTIC filter material, which can remove submicron particles from fluids and gases, is described in a new leaflet from Gelman Instrument Co.

Gelman said that the filter is available with "holes" so small that it can remove the smallest virus particles from solutions. The company went on to say that the filter's smooth surface makes it ideal for examination of contaminants in air, fuel, and hydraulic fluids. **(96)**

TWO NEW BULLETINS describing the RE series of top-entering Lightnin Mixers have just been released by Mixing Equipment Co. Inc.

According to the company, the RE is a complete mixer, with a solid drive shaft that is coupled directly to the mixer shaft. Both RE mixers (the REC closed-tank mixer, and the REQ open-tank type) have the following advantages: precision bevel gears; splash lubrication; easy-to-get-at change gears; overhung shafts; and easy maintenance and delivery setups. **(97)**

MANITOWOC ENGINEERING CORP. has issued an 8-page catalog describing its 125-ton-capacity Model 4000 lift crane. The company said that the Model 4000 is one of the biggest-capacity lift cranes in existence.

Some of the crane's outstanding features, according to Manitowoc, are: a heavy, massive rotating base, with huge hook and house rollers; big, stable undercarriage; and long, wide-spread crawlers. Without extensive advance preparations or dismantling, the unit can be put on a standard railroad flat car, for fast moves between jobs. **(98)**

TWO-COLOR WALL CHART (21 x 32 in.), which is a quick reference for all Anchor reusable hydraulic hose, couplings and fittings, has just been released by Anchor Coupling Co. Inc.

Anchor's wall chart is, according to the company, information-packed (illustrations, dimensions, etc.), and enables fluid power users to find easily the catalog numbers of all the listed company products. **(99)**

J. I. CASE CO.'S new 9,000-lb-capacity, four-wheel-drive, rear-wheel-steer unit, the W-12, is detailed in a new 16-page catalog.

Some of the W-12 features discussed are: improved balance and stability; heavier construction; economical diesel engine; interchangeable buckets, with 1⅝ and 2½ (std.) and 3½-cu-yd- capacities. **(100)**

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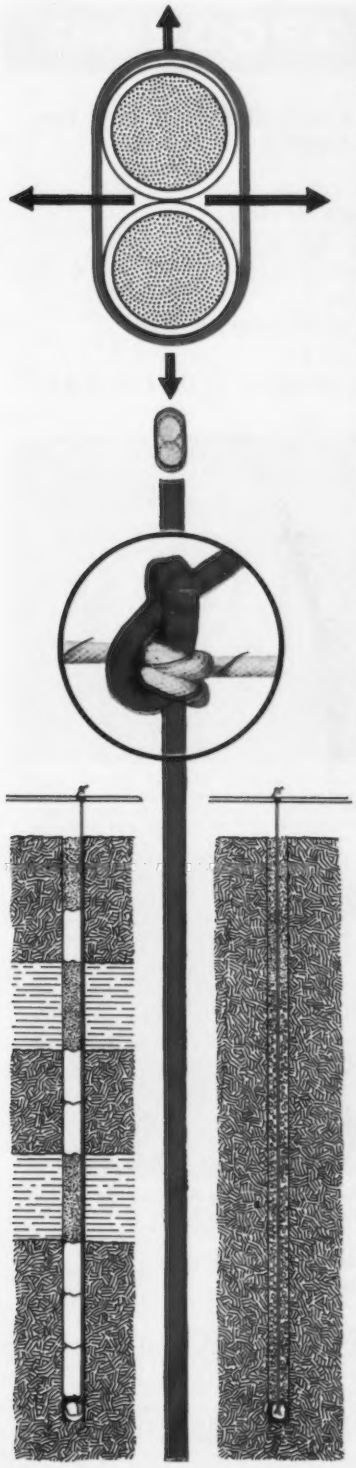

. . . wherever you are now using conventional 150-175 grain nominal coreload detonating fuse as sole initiator for certain types of uncoated AN-Fuel Oil mixtures

Extensive testing has established enhanced directional initiating strength from the twin cavities of the Figure 8 cross-section.

New 50 DUPLEX Primacord consists of two Primacord-type cords laid side by side and covered with a bright red plastic jacket. This construction develops a Figure 8 cross-section of the two cords forming two opposing V-shaped cavities which run beneath the jacket for the full length of the cord. This construction provides directional initiating strength effectively equivalent to that of 150-175 grain nominal coreload detonating fuse with single core.

Primacord	Total Coreload	Major O.D.	Minor O.D.	Tensile Strength	Weight (Per M Ft.)
50 DUPLEX	100 Grain ±10%	.323" ±.008"	.178" ±.008"	170 lbs.	24 lbs.

Advantages of 50 DUPLEX PRIMACORD

Less expensive than either the 150 or 175 grain detonating fuse with single core.

More flexible and lighter in weight.

Furnished in 500-ft. lengths. Does not need end seals — can be cut and applied in the field as easily as the standard types of 50-60 grain Primacord.

Easier to connect to Primacord trunklines with tight knot connections.

50 DUPLEX PRIMACORD is initiated with fuse and cap or electric blasting caps, or through proper knot connections to trunklines of Plain, Reinforced or Lo-Temp Primacord.

Warning: 50 DUPLEX PRIMACORD is recommended as the sole means of initiation only for certain types of uncoated prill-oil mixtures, or wherever 150-175 grain nominal coreload detonating fuses with single cores are now being used *successfully* for direct initiation of such mixtures. In case of doubt consult your explosives supplier or communicate with this company.

Just off the presses! New edition Primacord book is a catalog and condensed manual of proved blasting techniques using standard Primacord brands in mining, stripping, quarrying, ditching and construction work. Write to the Company for free copy; give name, title, company address, and tell us about the job.

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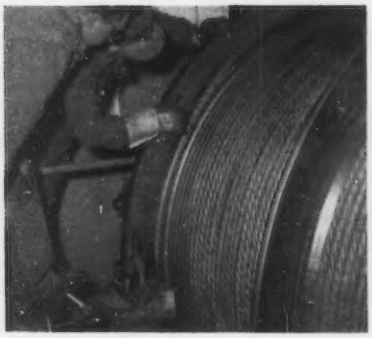
and at the same time obtain LeBus Controlled Spooling for multilayer spooling operations

See movies of these operations at LeBus Booth, Las Vegas Mining Show October 10th to 14th

- Change your cast iron drum core and flanges to steel
- Change groove size for larger lines when going deeper
- Increase wire line service over any present multilayer spooling
- Eliminate cutting through of line and excess scrubbing at the crossovers

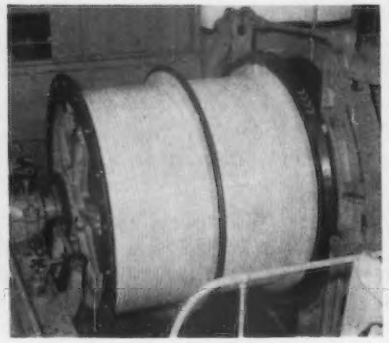


(1) This view shows one method of removing tapered wedges or end fillers on helical grooved cast iron drum.

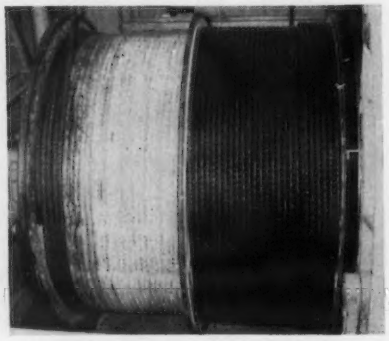
(2) Shows process of drilling a steel sleeve to be bolted to a cast iron drum.

(3) Shows installation of steel sleeves and steel ware plates on the flanges and welding the sleeves and plates firmly together giving a complete steel drum core and flanges.

(4) Shows installation of LeBus grooved segments to the steel drum core by the process of welding.



(5) Completed installation showing LeBus Counterbalance Spooling System installed on a 72" by 36" double drum for 1-¼" line.



(6) View shows overwind and underwind spooling operation where 3 and ⅓ layers of 1-¼" line are being spooled on to the drum.

Five more skips per hour have been made possible by installation of this LeBus Counterbalance Spooling.

LEBUS **LEBUS INTERNATIONAL ENGINEERS, INC.**

Box 2352, Longview, Texas Phone: PLaza 8-5522

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P. O. Box 992 Telephone: 1672
Fairmont, West Virginia

Salmon and Company
P. O. Box 2388 FAirfax 4-0625
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Recover more of these minerals with Armour amine reagents ...for as little as 7¢ per ton of ore!

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Phosphate
Beryl
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Hematite
Kaolinite
Mica
Potash
Silica
Vermiculite

Armour cationic flotation reagents produce the fastest attachments to minerals known—selectively float more concentrate in less time, at less cost!

Increased recoveries of minerals listed here—plus greater throughput—are economically achieved with Armour flotation reagents. That's because the coating reaction between an Armour flotation reagent and the *specific* mineral you want is *instantaneous!* Armour-treated minerals then attach to rising air bubbles quickly, firmly.

You use less equipment too, because the sharp selectivity of Armour cationic flotation reagents enable you to recover minerals without using an extra cleaner flotation step. You can float minerals from one ton of ore for as little as 7¢!

Armour—first to develop the use of cationic chemicals in flotation—continues to lead the way toward improved methods of applying these chemicals. Results of broad Armour research and experience are available in the 20-page booklet detailing the characteristics and advantages of cationic chemicals in flotation. Send coupon for informative booklet today!

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"Mineral Flotation with Armour Cationic Chemicals"..... ☐

Sample for floating_____

Information on these minerals (listed above)_____

Name_____

Firm_____

Address_____

City_____ State_____

E-10

Industry-proved through a quarter century of service . . . **THERE'S NO DOUBT ABOUT NEOPRENE**

IS THERE A "WEAK LINK" IN THIS MINING OPERATION?

One of the first places to look is that long, vulnerable length of power cable stretching out from the shovel. It takes a real battering: crushed under tractors, dragged over sharp rocks, exposed to temperature extremes, weather, and sunlight. It takes a really rugged cable jacket to keep electrical service intact under these conditions.

But it is no worry on this job. Reason: the Anaconda cable used is jacketed with tough, durable neoprene. This particular one has been in service at Maumee Collieries' strip mine for over *ten years.*

Neoprene is the *only* cable-jacketing material with records like this to *prove* its ability to protect electrical service under the toughest mining conditions. Neoprene jacketing resists oil and grease, chemicals, heat, cold, abrasion, gouging, impact . . . and it won't flow under heat or pressure; it is flame resistant as well. There's no doubt about neoprene synthetic rubber. Write for complete facts to E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department EMJ-10, Wilmington 98, Delaware.

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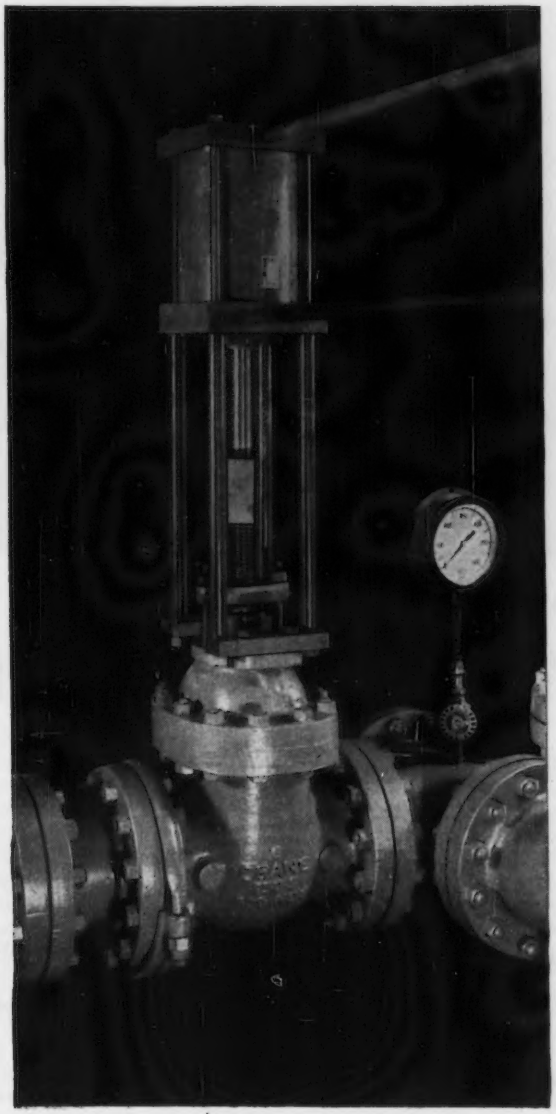

Now you can control any flow process easier and faster with cylinder operated Crane valves. Large valves . . . valves in remote or inaccessible locations . . . valves that must be cycled many times a day . . . all these can now be operated at the touch of a finger, saving time and manpower. These benefits of power operation are available from Crane now—at lower cost and in less time than ever before!

Crane cylinder operators are available for Crane O. S. & Y. iron body wedge and double-disc gate valves, and for pulp stock valves. Control devices for local or remote actuation supplied at extra cost.

And you can get these new operators for modernization of your present Crane gate valves, too. Easy-to-install adapter is shipped with every cylinder. Field installation can be done in 30 minutes or less, without removing the valve from the line.

This new valve operator is another example of how Crane solves your flow problems more economically, more productively. The Crane solution —the right answer to your flow problems—is as close as a phone call to your Crane distributor. Call him today.

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Heating • Air Conditioning • Cyclotherm® Boilers • Heat
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ARMS CUTTING BLADE WITH HARD, TOUGH EDGES

Steel

Look for the STEELMARK on the products you buy; place it on the products you sell.

The business end of this land-clearing blade takes a real beating from terrain and timber. It downs brush, trees of all sizes—everything in its path. Shears off stumps at ground level. Piles cut materials into windrows. Drives its stinger through sturdy large trees to split and weaken them. Cuts a wide swath below ground level to build V-type drainage ditches. Works long, hard and fast. ◆ The point of it all? Edges made from ¾" and 1" X-A-R 15 with a hardness of 360 BHN. X-A-R is the name for tougher, harder alloy steels developed by Great Lakes Steel especially to meet abrasion problems. They're made to work better and last longer wherever materials collide with equipment—as liners, teeth, bars, blades, and plates for example. *Under conditions that commonly wear out equipment in a hurry, X-A-R*

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Rome K/G Clearing Blades made of X-A-R—manufactured by Rome Plow Company, Cedartown, Georgia

FOR QUICK, ECONOMICAL LAND CLEARING

outwears any other type of steel. ◆ Close control during heat-treating, quenching and tempering is the secret of low carbon alloy X-A-R steels. And workability is as favorable as their hardness and toughness. Difficult problems, such as welding under cold conditions or extensive flame cutting, are handled well by X-A-R 30. For *extremely* difficult problems, choose X-A-R 15. ◆ X-A-R abrasion resistant steels, supplied in hardnesses from 360-400 BHN (or, by agreement, in lower Brinell hardnesses), are immediately available in ⅛″ to 1″ thicknesses, widths up to 72″ and lengths up to 35′. For complete technical information, write Great Lakes Steel Corporation.

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Make your mine openings self-supporting with

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CF&I Rock Bolts reduce the need for costly and clumsy mine timbering. Mine openings may be smaller or the space saved will allow freer, more efficient movement of machinery. Ventilation is improved, too.

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CF&I also makes a complete line of 1" Wedge Type Rock Bolts, as well as ¾" expansion type slusher pins.

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NO GUESSWORK... QUALITY IS CERTIFIED!

With Republic Mine Roof Bolts steel chemistry, yield point, and break point are known quantities

Republic takes the guesswork out of mine roof bolt buying. You get certified performance. Performance you can depend on every time, because every step of Republic Mine Roof Bolt manufacture—from raw ore to finished bolt—is carefully controlled, precision checked, and inspected. Every Republic bolt shipment includes a certificate stating specific physical properties of the steel used.

Five certified-performance features—you get them only from Republic—add up to an extra margin of mine safety. Economy? Mining companies report Republic Bolts are making profitable operations possible in areas where the high cost of shoring could force mine shutdowns.

Because mine roof bolts can be used effectively in many different types of strata, no single design is best for all applications. Republic's Field Service Team has worked with mine operators in every part of the country to develop bolts to best meet specific requirements. This obligation-free service is available to you. Write or send coupon today.

1 PRECISION-TAPERED PLUG

Engineered for proper shell expansion. Precise degree of taper required for strength, dependability, efficient tightening.

2 HIGH-STRENGTH, ALL-PURPOSE EXPANSION SHELL

Wide, strong leaves mean extra holding power. Narrow base supports for easy expansion, wedge-like grip.

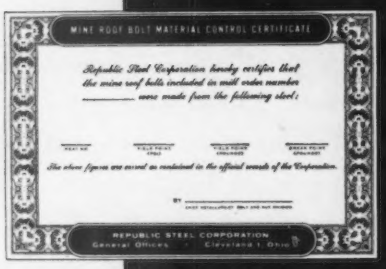
3 HEAVY-DUTY SUPPORT NUT

Provides better support for shell than previous methods. By stripping without damage to bolt threads at 50 pounds torque, proper tension in the installed mine bolt is assured.

4 IMPROVED SELF-CENTERING HEAD Compact, one piece head. No separate washer needed. Forged for ruggedness and strength.

5 MATERIAL CONTROL CERTIFICATE

Included with every shipment. States specific physical properties of the steel used: yield point, break point, and steel heat number.


MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE

Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:

The above figures are record as contained in the official records of the Corporation.

BY _____

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General Offices Cleveland 1, Ohio

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CORROSIVE ELEMENTS,
and moisture, found around mining operations, are tough on standard conduit. Answer: *Republic* ELECTRUNITE® "Dekoron®-Coated" *E.M.T.*, made from highest-quality flat rolled open hearth steel, armor-coated from end to end with corrosion-proof polyethylene. Easy to cut to length and bend to fit installation. ELECTRUNITE "Dekoron-Coated" E.M.T. costs less to install, less to maintain. Plastic coated rigid steel conduit also available. Mail coupon for more information.

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of *Republic High Strength Steel* makes it ideal for use in coal and ore discharge chutes, hopper and mine cars. Equipment built with Republic High Strength Steel withstands continual pounding and abrasion, is more corrosion-resistant and weighs less than similar equipment constructed of plain carbon steel. Send coupon for additional information.

MINE WATER PROBLEMS?
Solve them the easy, low-cost way—with *Republic Flexible Plastic Pipe*. Made of tough polyethylene, it is impervious to corrosive elements found in mine water. Lightweight Republic FE® Plastic Pipe is easy to handle, easy to cut and join. Can be quickly relocated to meet changing conditions. Mail coupon for further information abouf Republic Plastic Pipe.

AVAILABLE PRE-ASSEMBLED
TO CUT YOUR INSTALLATION COSTS

You can order your Republic Certified-Performance Roof Bolts fully assembled to save you assembly costs, prevent loss of parts and damage to bolt threads. Specify Republic Roof Bolt Plates, too.

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Please send me further information on:
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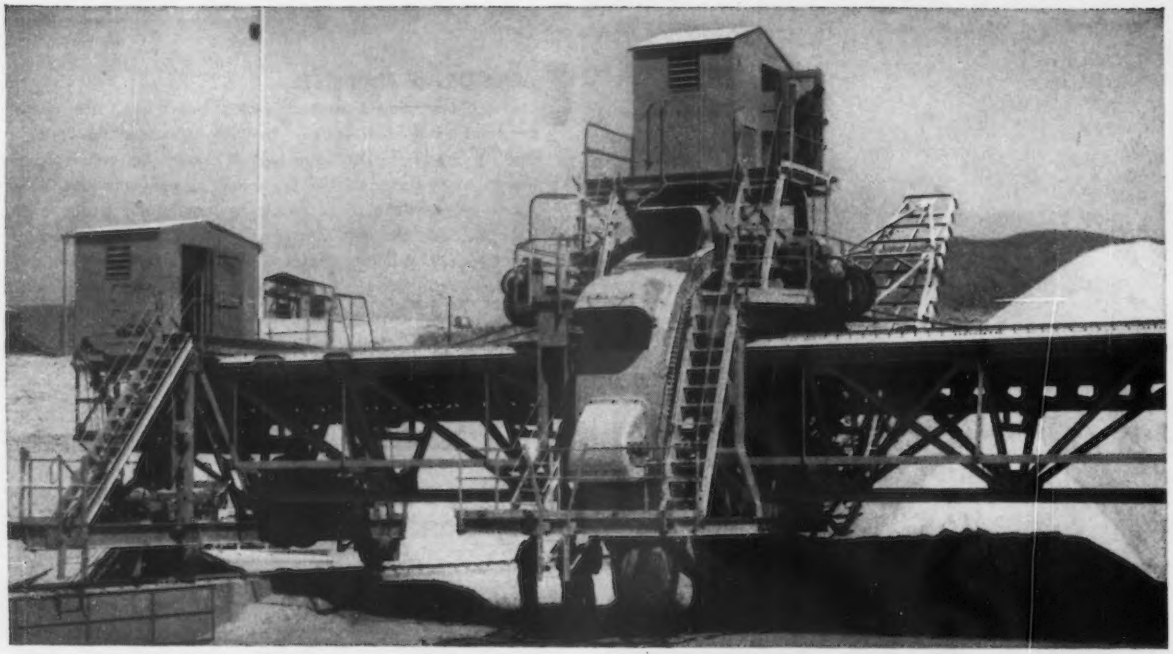
☐ Plastic Pipe
☐ ELECTRUNITE "Dekoron-Coated" E.M.T.

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____



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It blends...it reclaims...it ends inefficiencies of selective mining

As part of a new H-R Rotary Bucket Wheel Blending and Reclaiming System, this giant 3-story wheel is capable of processing efficiently a broad range of materials . . . especially where more than one of the following typical situations exist:

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2. Unable to comply with specifications
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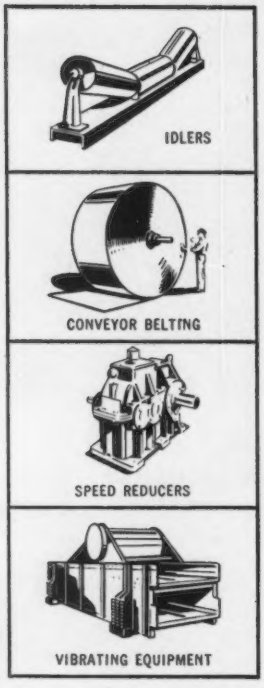
4. Storage pile requirements range 50,000 tons and over
5. Two or more types of raw material to blend for chemical compounding.

For full details consult your H-R representative, or write Hewitt-Robins, Stamford, Connecticut. Ask for Bulletin 10-16



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550-hp Cummins VT-12-700 Diesel. Allison Torqmatic transmission with 6 speeds forward to 46.6 mph. Net weight 62,000 lbs.

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In all 5 LeTourneau-Westinghouse Haulpaks you get production advantages no other off-road hauler can offer!

Hydrair® suspension

Haulpak rides on air, not steel. *No* springs, *no* front-axle or related maintenance. Less deadweight. High, 20 to 28-inch ground clearance, short turns. Four simple Hydrair units cushion load and road shocks, keep load riding level.

"Bonus-tonnage" V-body

Consider the extra load capacity you get within short wheelbase. Deep V-body carries about 6 tons of material below normal floor-line. Center of gravity is *low*. Exhaust-heated body prevents material from sticking or freezing-in.

Power-transfer differential

Now, for the first time on a truck, you get the job-proved LW power-transfer differential. In soft, muddy going, differential *automatically* slows slipping wheel, transfers up to *4 times* the tractive effort to drive wheel on firmest footing.

Short turn maneuverability

Haulpak turns in ⅓rd less space than comparable-capacity haulers, and much shorter than many smaller rigs. You have short wheelbase . . . and sharp-angle turn, because there's no spring or axle obstruction at front wheels.

More net usable power

Engine power is conserved many ways: light-weight super-strong steels used throughout body and frame . . . short simplified drive train . . . "power-miser" fan (requires only 10 hp, compared with 30 to 35 hp needed for conventional fans). Thermostatically-controlled fan also starts or shuts off *automatically* as needed . . . releases more horsepower for extra tractive effort.

Other cost-cutting features

Multi-disc air brakes (biggest, safest in the industry) . . . quick accessibility (reduces servicing time) . . . interchangeable tires, Hydrair units and other components (you can operate a Haulpak fleet on a *minimum* parts inventory).

No matter what the size of your operation . . . or your hauling problems . . . LW Haulpaks can give you bigger production at lower cost. We'll be glad to give you complete details and to arrange a demonstration . . . no obligation. HP-2355-G-2

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

L•TOURNEAU LW WESTINGHOUSE

NACO ALLOY BALLS

through closer metallurgical control

ROCKWELL	BRINELL
63	710
61	670
59	638
57	601
55	555
53	534
51	495
49	477
47	444
45	429

1½ 1⅛ ¾ ⅜

Distance from surface—inches

tumble per-ton grinding *costs*

Through precise laboratory controls of the elements in steel making — from spectrographic analysis through final heat treating — Naco Grinding Balls possess the correct structure and hardness for maximum impact absorption and wearing qualities. Structurally, Naco Grinding Balls have a grain akin to tool steel — tough, hard and rugged. Laboratory tests show remarkable uniformity in solidity and controlled hardness holding to desired depth. Every day more mill operators are tumbling to the cost-saving advantages of Naco Grinding Balls.

CAPITOL FOUNDRY DIVISION
POST OFFICE BOX 750
PHOENIX, ARIZONA

NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

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A-1658A

product:

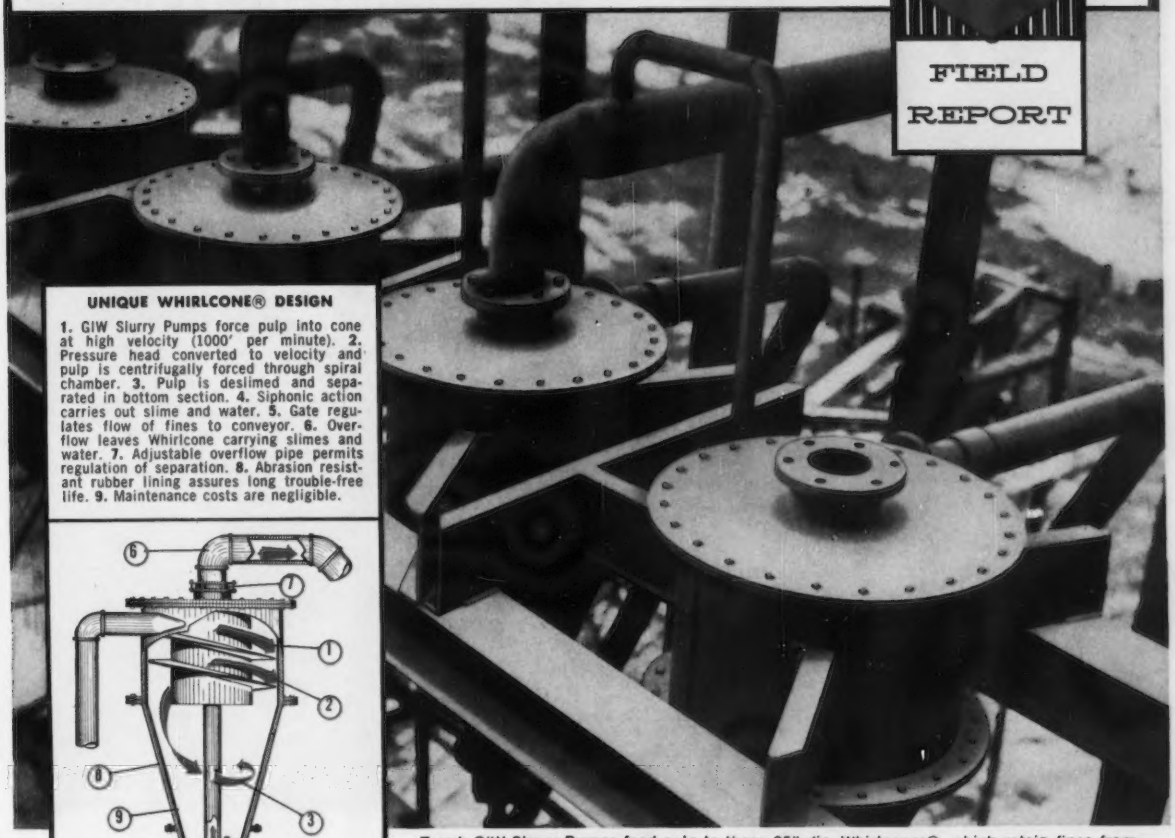
COTTRELL WHIRLCONE® SEPARATORS

customer:

BECKER COUNTY SAND & GRAVEL CO.

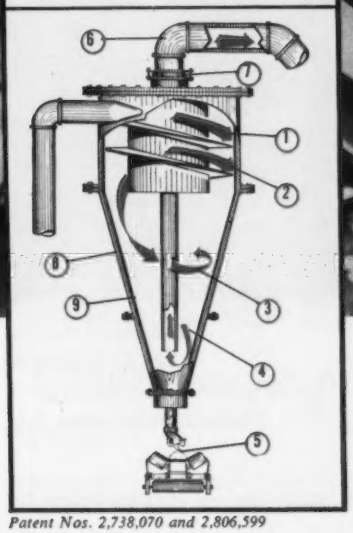
GIW

FIELD REPORT



UNIQUE WHIRLCONE® DESIGN

1. GIW Slurry Pumps force pulp into cone at high velocity (1000′ per minute). 2. Pressure head converted to velocity and pulp is centrifugally forced through spiral chamber. 3. Pulp is deslimed and separated in bottom section. 4. Siphonic action carries out slime and water. 5. Gate regulates flow of fines to conveyor. 6. Overflow leaves Whirlcone carrying slimes and water. 7. Adjustable overflow pipe permits regulation of separation. 8. Abrasion resistant rubber lining assures long trouble-free life. 9. Maintenance costs are negligible.



Patent Nos. 2,738,070 and 2,806,599

Tough GIW Slurry Pumps feed pulp to these 25" dia. Whirlcones®, which retain fines from classifier overflow. Maximum recovery rate is 20 tons per hour per cyclone. The cones will handle material from −12 mesh to lightest slime.

Whirlcone® Separators solve difficult fine recovery problems.

The retention of fines in the −50 plus 200 mesh range posed a disturbing problem for the Becker County Sand & Gravel Co., of Cheraw, S.C., primarily because the large amount of water used in processing the sand and gravel washed out the desirable fines with the minus 200 slimes.

Fourteen 25" dia. Whirlcone® wet type cyclones installed parallel in four Becker plants solved this problem completely. Operating an average of 8 hours daily, they extract up to 100 tons of clean, fine sand per hour from wash water while the minus 200 mesh slime is discarded.

Recovered fines are used to bring sand up to specifications. Thousands of tons of valuable sand, formerly lost, soon paid for the low cost of the Whirlcones®.

GIW's highly efficient Whirlcones® are also being used in the mining fields to deslime, degrit, classify, concentrate, make dam and mine backfill and to dewater or thicken where the overflow can be returned to the process or it can be discarded.

They are available in diameters from 6" to 50". Capital cost including the pump is 20 to 50% of conventional classifiers.

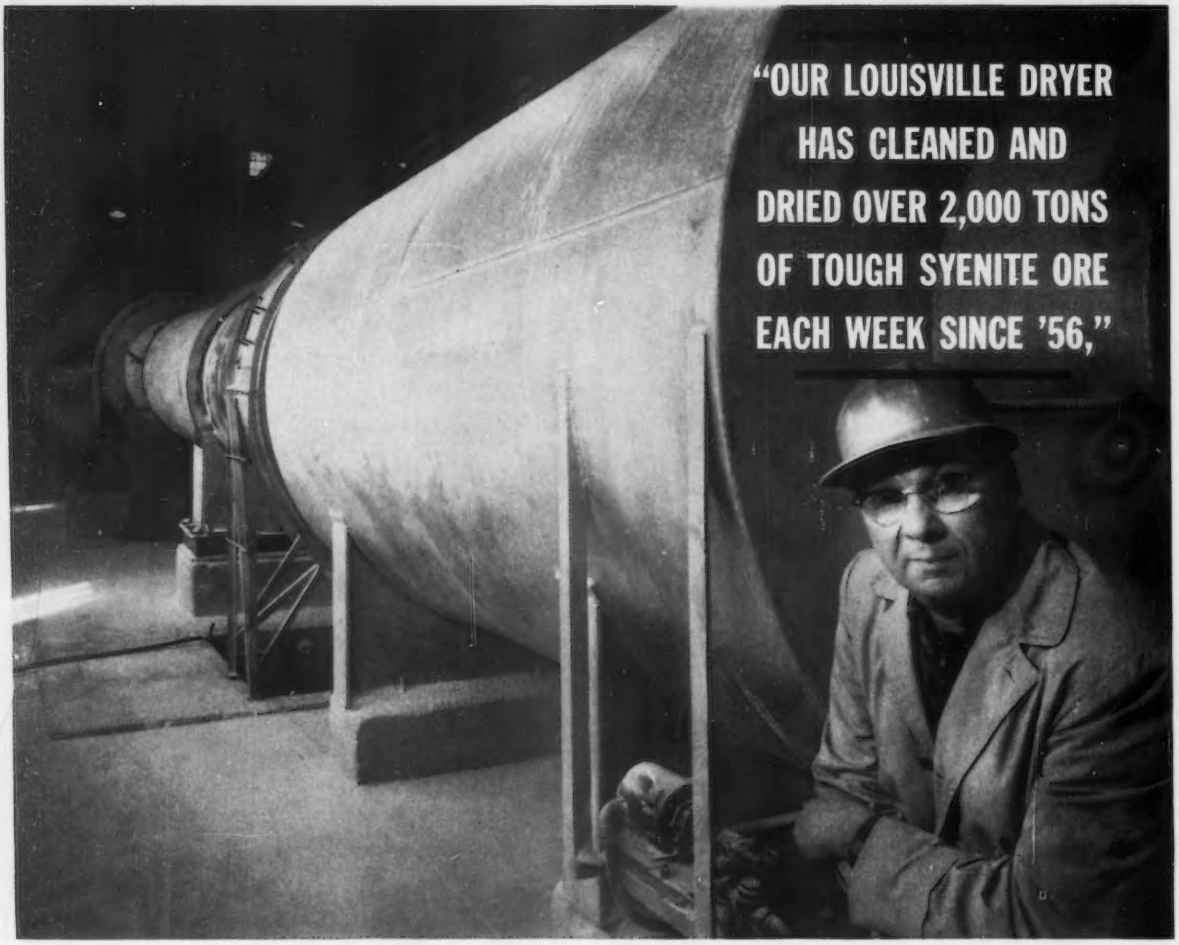
If you are losing fines from material −12 mesh to lightest slimes, write today. Recommendations and literature will be forwarded promptly.

COTTRELL ENGINEERING
Division of
GEORGIA IRON WORKS CO.

GIW

Manufacturers of pumps, dredges, separators and accessories.

AUGUSTA • GEORGIA



. . . says superintendent
Leo F. McDonnell
of International Minerals &
Chemical Corporation, Ltd.

The International Minerals & Chemical Corporation, Ltd., likes this Louisville Dryer for three reasons. It requires minimum operating manpower, minimum maintenance and shows remarkably little wear.

Completely automatic, it is operated by only one man. The drum itself, which is made of ¾ inch plate steel still shows no sign of inside wear, even after processing thousands of tons of tough, abrasive nepheline syenite ore. Maintenance of the dryer is a simple matter easily accomplished by plant personnel.

Says superintendent Leo F. McDonnell, "We have enough ore to keep us going for a hundred years or more. We have every reason to believe that the Louisville Dryer will be giving good reliable service for a good many of those years."

If you have a drying problem, remember—*it pays to plan with General American.*

GENERAL AMERICAN TRANSPORTATION CORPORATION

Process Equipment Division—Louisville Dryers

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Chicago 3, Illinois
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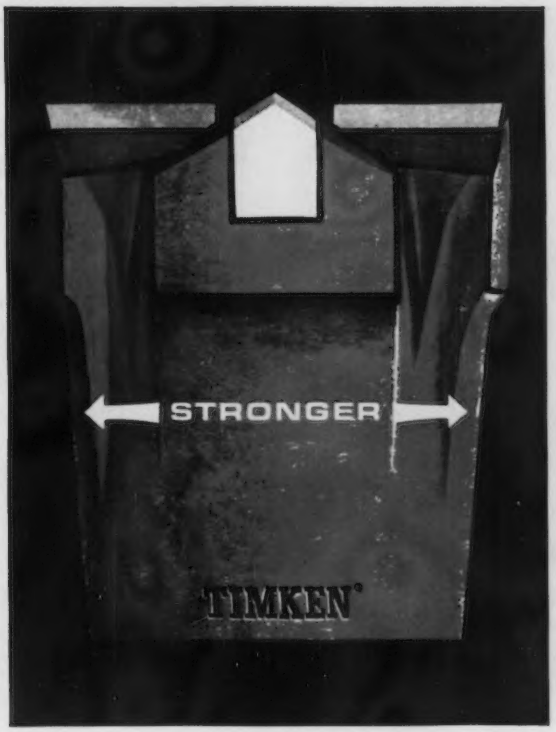
TRADE MARK

TIMKEN® THREADED BIT NOW BETTER 2 WAYS!



1. GIVES LONGER BIT AND INSERT LIFE

Improved two ways, the Timken® threaded carbide insert bit gives you more hole-per-bit, lower drilling costs. A new brazing process bonds the carbide inserts firmly to the bit body to resist shocks better. Longer insert and bit life results. Drilling goes smoother and faster.

And a new heat treating process gives the bit bodies a harder outer surface for better wear-resistance, plus a tough yet resilient inner structure for greater shock-resistance. This added, uniform strength practically eliminates ring-off and breakage.

2. RESISTS RING-OFF AND BREAKAGE

You save in other ways too. The five front hole design, pioneered by the Timken Company, shoots air or water directly against the rock face to speed chip removal. The wider wing clearance lets chips clear faster. The deep, tough special analysis carbides can be re-conditioned many times.

And with Timken bits you get the kind of "on the job service" you can't get anywhere else. It's another reason why they're used by more miners and contractors than any other removable rock bit. Timken threaded bits are available in a complete range of sizes and types. For full details send for free brochure, "Timken Removable Rock Bits". The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

FOR OTHER TOUGH DRILLING JOBS

ALL-STEEL MULTI-USE

This improved Timken bit gives lowest cost per foot-of-hole when you can drill out full increments of steel.

TAPERED SOCKET BIT

Secure union gives the strength of one-piece steels. You get the same chip removal features as with the threaded bit shown above.

Call on us at the AMC Metal Mining Show, Las Vegas Convention Center, Oct. 10-13, Booth 318.

TIMKEN®

removable rock bits

PEABODY COAL COMPANY
SUNNYHILL MINE
1650-B

The tail that wags the dog—

USS Tiger Brand Amerclad Cable

This 65-cubic-yard shovel scoops overburden at the rate of 1,500,000 cubic yards a month at the Sunnyhill Mine of the Peabody Coal Company. It operates on a 6,900-volt electrical system and has a 9,000 horsepower capacity including all motors.

Power is supplied through a USS Tiger Brand Amerclad Cable. The cable takes a lot of abuse in its long run under a roadway, through a creek and over jagged rocks. It is standard 8KV three-conductor Type SH-D cable. The insulation is tough, flexible Amerzone rubber. Each conductor is shielded for safe handling with a close serving of tinned copper wires securely bound in place and supplemented by heavy copper ground conductors. Such a shield provides the flexibility lacking in a full copper braid and avoids the break-up of the wires due to chafing at cross over points.

Ground wires, Neoprene fillers and a heavy, tough, reinforced jacket of oil resistant Amerprene complete the cable. And by providing positive clearing of the cable in case of a "short," this construction is tops in safety.

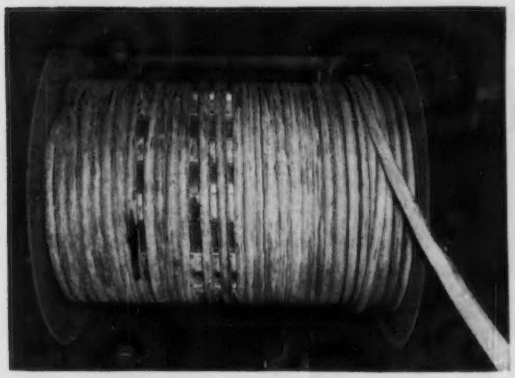
American Steel & Wire also makes Armorlokt cables, bore hole cables and a complete line of power distribution cables noted for their high quality. For complete information, write American Steel & Wire, Dept. 0375, 614 Superior Ave., N.W., Cleveland 13, Ohio, or contact our nearest distributor.

USS, Tiger Brand, Armorlokt, Amerclad, Amerprene and Amerzone are registered trademarks

USS Tiger Brand Electric Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable



Greater flexibility of Amerclad permits constant reeling and unreeling.

Constant exposure to mud, acid mine water, abrasion and weather doesn't harm Amerclad Cable.

The tail that wags the dog. Tiger Brand Amerclad Cable (foreground) is the finest you can get for big shovel power supply.

American Steel & Wire
Division of
United States Steel

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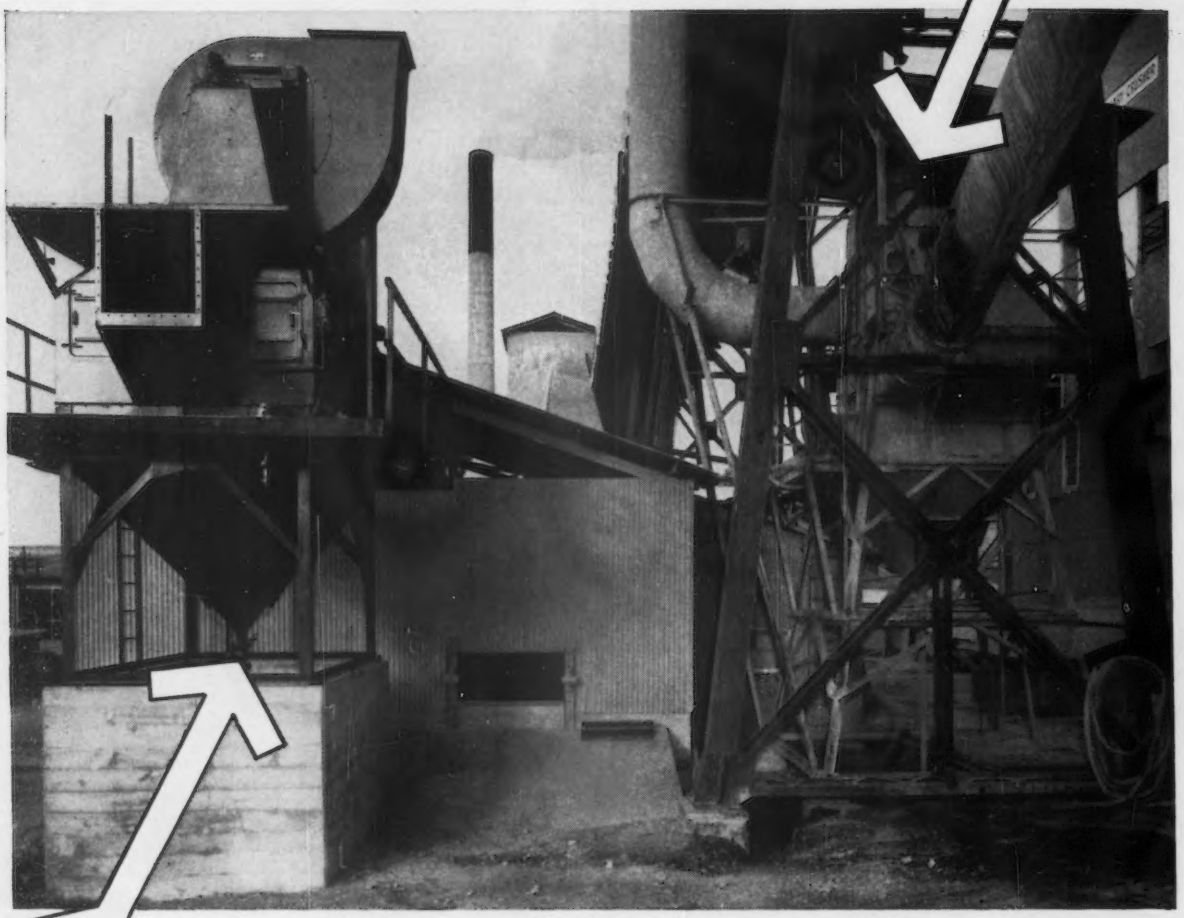
United States Steel Export Company, Distributors Abroad

AAF dust collector retiring after 23-year hitch...



...new model ready to take over!

The hard-bitten AAF Type W ROTO-CLONE at right has done its job well at this copper processing plant. It has taken the toughest treatment that crusher dust could dish out *for 23 solid years.*

But even if it could give some "fatherly advice" to its shiny new replacement, the newcomer wouldn't need it. The *new* Type W is tougher and more efficient in every way than the old timer. Water sprays extend the effectiveness of its dynamic forces to collection of the finest and lightest dust particles. It requires little maintenance, uses a minimum of water and maintains its efficiency regardless of air volume.

For complete product information, call your local AAF representative or write direct for Type W ROTO-CLONE Bulletin 274B. Address: Mr. Robert Moore, American Air Filter Company, Inc., 193 Central Avenue, Louisville, Kentucky.

AAF **American Air Filter**

BETTER AIR IS OUR BUSINESS

HEAVY DUTY HYDRASTROKE* FEEDER for MINES and MILLS

A Reciprocating High-Tonnage Feeder easily adapted to feed Belts, Trucks, Skips, Railroad Cars, Screens and Crushers

PATENT APPLIED FOR

Exclusive HYDRAULIC OPERATION

HYDRAULIC OPERATION

Exclusive hydraulic power drive supplies the fluid to a cylinder which reciprocates the deck. Fixed or variable feeding rates are easily available through the use of a fixed or a variable volume pump. Length of stroke can be varied from 6 to 24 inches.

MINIMUM HEAD ROOM

Head room requirements are reduced to as little as 20 inches. Impact damage is minimized because discharge lip of feeder is only 6 to 8 inches above lowest clearance line of feeder. Initial construction costs are reduced.

ROCKER MOUNTING OR SUSPENSION

May be installed with either rocker suspension or self-contained rocker mounted units. Eliminates costly wear due to friction which is present in other types of feeders. No lubrication is needed. Feeder can take severe shock loading.

Durability characterized by special rugged construction

Wide range of sizes available . . . widths from 36" to 96" . . . feeding capacities from 300 to 7500 tons per hour.

Write for illustrated brochure.

*TRADEMARK - REGISTERED

NICO **NATIONAL IRON COMPANY**

50th Avenue West and Ramsey Street Duluth 7, Minnesota

SUBSIDIARY OF PETTIBONE MULLIKEN CORP. CHICAGO 51, ILLINOIS

More proof that...

AMSCO HELPS YOU MOVE MORE TONS PER DOLLAR

How AMSCO screen parts and Simplex 2-Part Dipper Teeth are giving users greatly improved service life*

AT A LARGE NEW ENGLAND QUARRY

AMSCO CHUTE PLATES LAST 5 YEARS VS. 4 WEEKS FOR PREVIOUS TYPE

In the screen house of this quarry, two Amsco HC-250 abrasion-resistant chute plates are used on each Hi-G discharge screen. 500 tons per hour pass over each plate, during the two-shift, 20-hour operating day.

This installation resulted from a previous test, in which a set of Amsco plates was compared with regular carbon steel plates. The Amsco Chute Plates *lasted about 5 years*, whereas the competitive plates had to be replaced every 4 weeks.

The quarry operator reports that the Amsco plates presently installed are holding up excellently in service. Their exceptionally long life and trouble-free service means big dollar savings—through elimination of costly shutdown time.

ON THE NIAGARA POWER PROJECT

AMSCO SIMPLEX 2-PART TEETH DIG 40,000 YARDS OF ROCK BEFORE REPLACEMENT

At the right, you see the type of rugged rock excavation in which this outstanding service record was set. It's part of the Niagara Power Project—Conduit #2 South—being handled by Gull & Defelice Construction Company.

All dippers on the job are equipped with Amsco Simplex 2-Part Reversible Teeth. They operate 16 hours a day, 6 days a week—*handle approximately 40,000 yards of rock*—before tooth replacement is required.

In addition to their exceptionally long wear, the fact that Simplex Teeth *can be replaced in ten minutes with no trouble* is an important advantage to the operators. It all adds up to big savings—in replacement cost and shovel downtime.

*Patent No. 2,904,908

Wherever high impact and abrasion are problems, you'll "move more tons per dollar" with Amsco Dippers, Dipper Teeth and Crusher Parts. See your equipment dealer, or write us direct for technical bulletins.

AMSCO

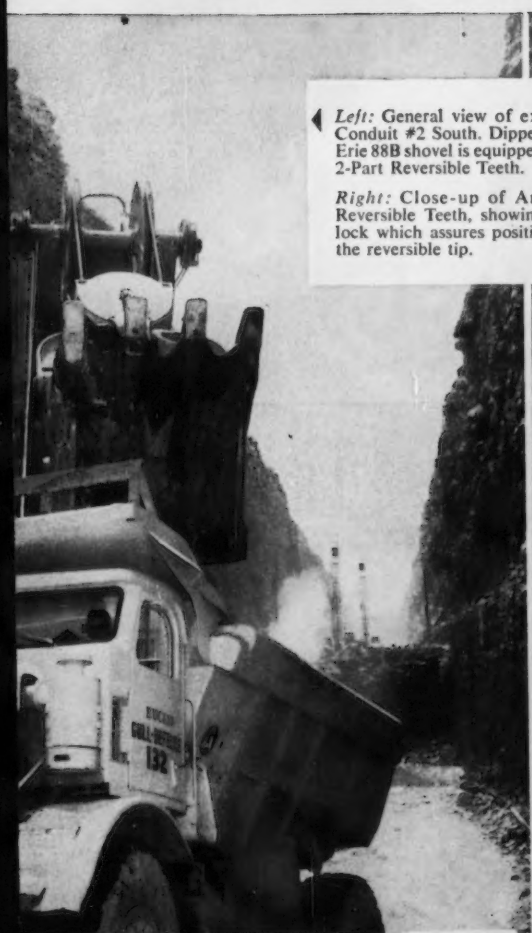
American Manganese Steel Division • Chicago Heights, Ill.

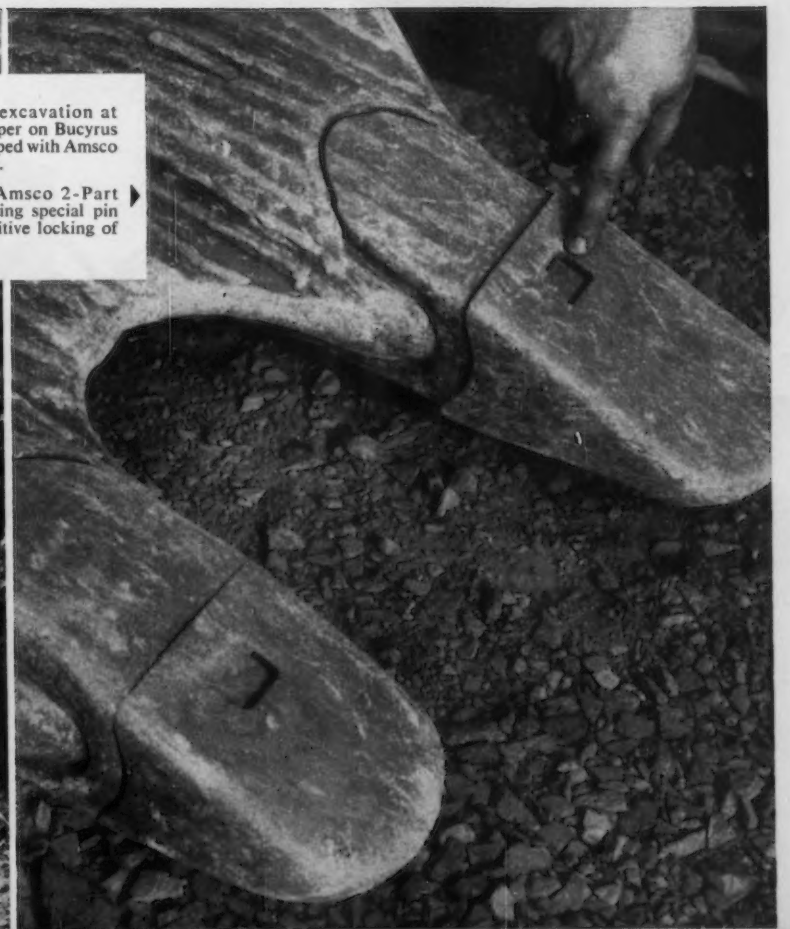
Other plants in: Denver • Los Angeles • New Castle, Dela. • Oakland, California • St. Louis
In Canada: Joliette Steel and Manitoba Steel Foundry Divisions

AMERICAN Brake Shoe COMPANY

Left: Close-up of Amsco Chute Plates used on each discharge Hi-G screen.

Right: General view of Hi-G screen in screen house of large New England quarry.



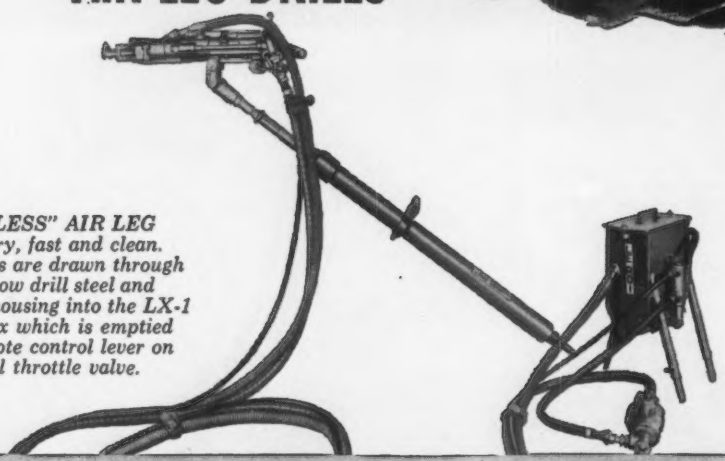


Left: General view of excavation at Conduit #2 South. Dipper on Bucyrus Erie 88B shovel is equipped with Amsco 2-Part Reversible Teeth.

Right: Close-up of Amsco 2-Part Reversible Teeth, showing special pin lock which assures positive locking of the reversible tip.

NO STUCK STEELS

WITH THE NEW LE ROI DUSTLESS AIR LEG DRILLS



NEW "DUSTLESS" AIR LEG drills dry, fast and clean. Cuttings are drawn through the hollow drill steel and chuck housing into the LX-1 dust box which is emptied by remote control lever on the drill throttle valve.

Steels never stick when they're on the business end of the *new* Le Roi LLV Dust-Collecting Air Leg Drill. The dustless drill melts its way through the hardest rock — piles up more drilling footage with a lower dust count than was ever possible with wet drilling.

Dry, dustless drilling permits continuous ore sampling — saves every speck of precious ore. It eliminates the need and expense of water — does away with wet, dangerous conditions; sinking pillars; lost holes; water and muck haulage.

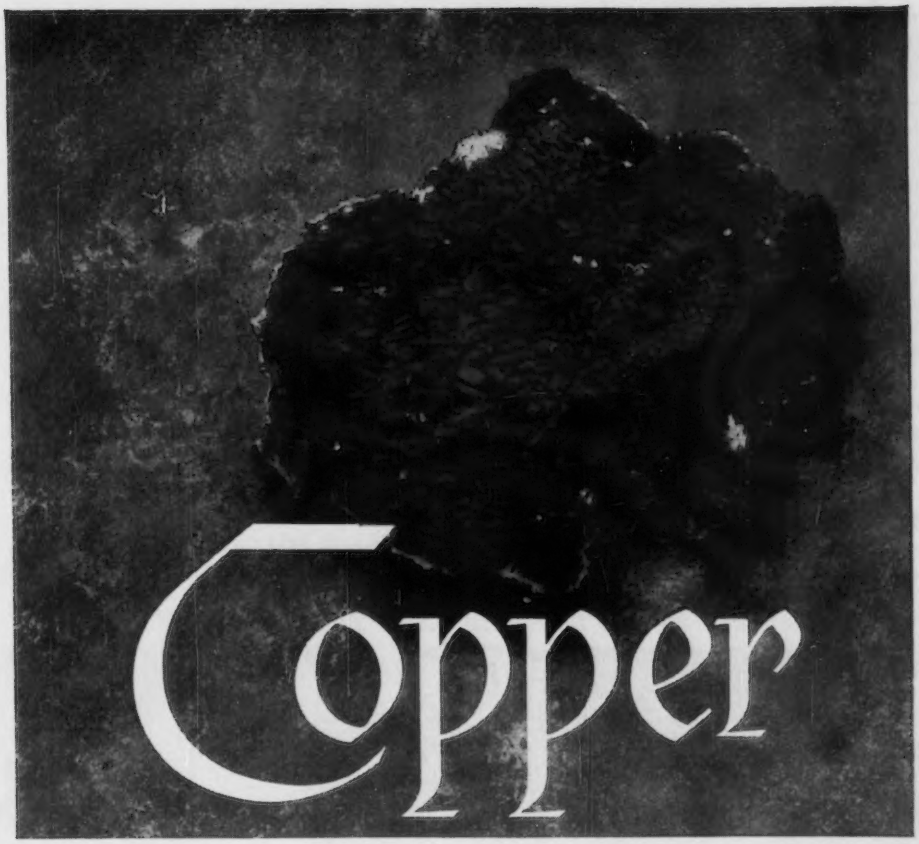
The LLV collects dust through the drill steel and exhausts it through the chuck housing — *not the machine!* It's ideal for mining or tunneling in hard rock — saves tools and operators.

Ask your Le Roi distributor for a demonstration. Or for more information, write to the Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wis.

LE ROI NEWMATIC® AIR TOOLS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

AT-907

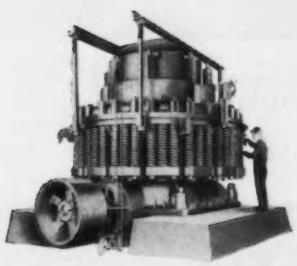


. . . symbol of money and power

The name *copper* is from the Greek κυπρος, Cyprus, one of the early sources of the metal. Copper has often been called "the common man's gold"—and has become a symbol of *money* due to its wide usage in the coins of many nations, as well as a symbol of *power*—since the greatest usage of copper has been as a conductor of electricity.

While native copper is the only metal found abundantly in nature, commercial production is supplied chiefly from various ores of copper, including chalcopyrite, chalcocite, cuprite and malachite.

Wherever these copper ores are processed—in Arizona, Chile, or the Belgian Congo—you'll find Symons Cone Crushers the leading choice among the world's prominent producers. For in copper . . . *as in all of the important ore and mineral operations around the world* . . . Symons Cone Crushers have consistently maintained their prominent position by efficiently processing large tonnages of finely crushed product at low cost.



SYMONS® CONE CRUSHERS
***. . . The machines that revolutionized crushing practice . . .* are built in a wide range of sizes, for capacities to over 900 tons per hour. Write for descriptive literature.**

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

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SYMONS . . . a registered Nordberg trademark known throughout the world

NORDBERG

SYMONS SCREENS

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS
SAN FRANCISCO • TAMPA • WASHINGTON • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.

Short cuts to more profitable mining

The natural versatility and mobility of rubber-tired "PAYLOADER" tractor-shovels has long been recognized and put to profitable use by the management of many mines in the coal, metallic and nonmetallic fields. The recent introduction of larger units — up to 300 h.p. and 12,000 lbs. operating capacity — with their correspondingly greater production capabilities, has further extended "PAYLOADER" acceptance and use. Many of these biggest units are already firmly established in key production jobs at mines, refineries and preparation plants.

Many Jobs in Many Mines

Some of the typical ways that 4-wheel-drive "PAYLOADER" units, large and small, are helping to boost tonnage and reduce the cost-per-ton are shown here. There are many other applications, particularly by the construction and maintenance departments of mines. The use of Drott "4-in-1" Buckets, Wain-Roy Backhoes and other useful attachments on "PAYLOADER" units has given new mobility, speed and efficiency to maintenance crews.

Sizes for Every Job

In the complete "PAYLOADER" line of 20 models in 8 capacity ranges, there are sizes and types to fit many needs and situations. Your Hough Distributor, with his complete parts and service facilities, backed by Hough field service personnel, invites your inquiry. See him today.

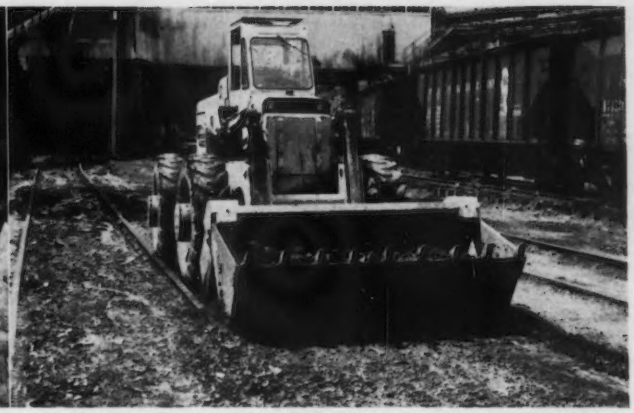
Cleaning Seams When a "PAYLOADER" cleans off the top of the vein, it does a smooth, precise job. There are no track lugs to chop and waste the coal.

Digging Tip-back, pry-out bucket action gets full loads of coal from the five-foot vein in this strip mine. Also cleans off the vein, builds roads, does maintenance.

Spotting Cars You can do your own car-spotting and switching with your "PAYLOADER" — also tow and push stalled trucks and other equipment.

Charging Hoppers "PAYLOADER" models are available to dump over hopper and bin edges up to 15 feet high, and eliminate the need for trucks, etc., on short hauls.

Underground In lead mine a model H-70 dozes fly rock, cleans up after shooting, and loads trucks. Gas scrubber on exhaust keeps CO count within safe limits.



Clean-up A "PAYLOADER" with Drott "4-in-1" clam-type bucket is a shovel, dozer, clam and scraper . . . a versatile combination for construction, maintenance, clean-up.

Loading Trucks Model H-120 with 8 cu. yd. bucket loads big coal trucks fast and easily — thanks to power steer, power-shift, and tip-toe action air brakes.

Loading Ore Careful load distribution is a **must** when you load a coal car with iron ore — but the high lift and long reach of the big H-120 does the job accurately.

PAYLOADER®

Feeding Grizzly Big H-120 maintains 400 ton per hour pace feeding ore from stock bins at a refinery — an average 100-ft. one-way haul.

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THE FRANK G. HOUGH CO.
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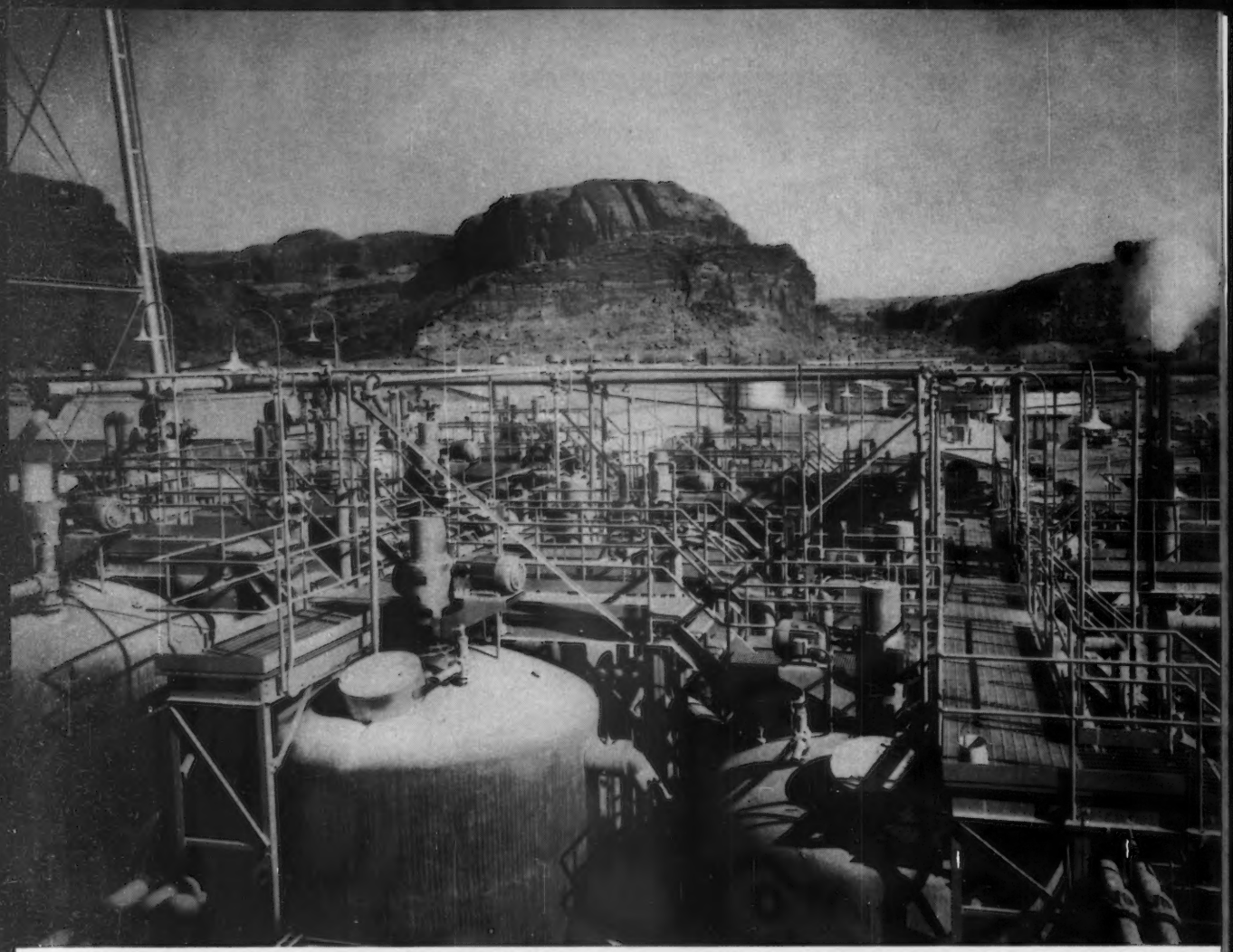

ALKALINE LEACH CIRCUIT, equipped with 12 Series "E" LIGHTNIN Mixers, handles high-lime ore with a 96% recovery at Ureco. Process design by Knowles Associates (Roman Chelminski). *Constructor:* Western-Knapp Engineering Co.

How they jumped capacity 60% at Moab

These twelve autoclaves were designed to leach 880 tpd of high-lime ore at Uranium Reduction Co., Moab, Utah. Now they're handling 60% more than design tonnage.

What made the boost possible?

Advance planning . . .

Before the mixers were bought, Ureco sent Mixco samples of the ore to be processed. Pilot plant tests were made, using calibrated LIGHTNIN mixing impellers to study closely how the full-scale plant would perform.

Then Mixco men scaled up the pilot data and selected standard LIGHTNIN Mixers that delivered the exact results predicted.

. . . and quick change

After the plant went on the line, Ureco engineers discovered they could step up the extraction rate with atmospheric preleaching and a higher level of agitation.

The unique construction of LIGHTNIN Mixers made it a simple matter to gear up for higher throughput. Only two gears had to be changed. And the job could be done by one man, without dismantling the mixer or disturbing the shaft or gearing alignment.

You, too

Good fluid mixing is what we sell. We've got the men, the experience, and the equipment to help you get more out of your ore. Faster throughput. Better extraction percentages. Tighter quality control. More product from fewer reactors. Guaranteed results—results you can measure.

For details, call your LIGHTNIN Mixer representative. He's listed in Chemical Engineering Catalog and in the yellow pages of your telephone book. Or write us direct.

Lightnin® Mixers

MIXCO fluid mixing specialists

MIXING EQUIPMENT CO., Inc., 234-k Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Avenue, Toronto 19, Ont.

in uranium ore processing...

TRONA®

SODIUM CHLORATE!

out-performs other oxidizing agents because of higher oxidizing power, economy and ease of handling

Experience proves that TRONA SODIUM CHLORATE is the best oxidizing agent you can use in the acid-leach process for recovering uranium values from its ores. $NaClO_3$ is more economical, too, because of its higher oxidizing power. It is rapidly and completely soluble; in the leaching circuit it forms a solution, not a suspension. Another advantage—Trona sodium chlorate shipping drums are suitable for re-use in shipping yellow cake. AP&CC, the largest domestic producer of sodium chlorate, has the knowledge, experience and facilities to produce a consistently better sodium chlorate for your milling operations.

TRONA® SODA ASH is used in acid and alkaline processes for the refining of uranium ores and as a pH modifier in the ore milling circuit. High quality Trona soda ash has applications also in the refining of lead dross and as an extractant of nonferrous minerals from low percentage ores by flotation.

Write for $NaClO_3$ facilities, technical data and applications bulletin. Also available —an attractive and functional wall chart for chlorate handling precautions.

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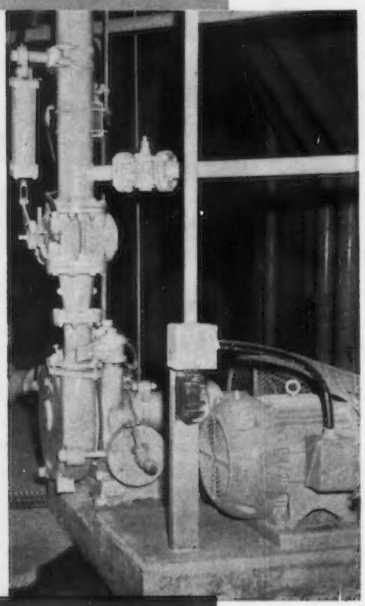
WHEN THE CHIPS ARE DOWN . . .

IT'S DEPENDABILITY THAT COUNTS

WILFLEY SAND PUMPS

When production schedules are tight, and economy a vital factor, put Wilfley Sand Pumps on the job. Wilfley's 24 hour, trouble-free operation reduces downtime to an absolute minimum. Rugged construction, simplified packingless design and Wilfley's easy parts replacement guarantee you dollar-saving dependability even under the most severe conditions.

Wilfley Sand Pumps may be fitted with interchangeable electric furnace alloy iron, special application alloys or rubber-covered wear parts. Write, wire or phone for complete details.



Wilfley Acid Pumps — "COMPANIONS IN ECONOMICAL OPERATION" — Wilfley Sand Pumps

Every Wilfley Installation Is JOB ENGINEERED

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ENGINEERING AND MINING JOURNAL

OCTOBER 1960

Dwindling U.S. Gold Reserves Enhance Chances for Domestic Subsidy

A RISING TEMPO of concern over dwindling U.S. gold reserves is reflected in business and financial publications. Despite early opinions in 1960 that exports would increase and the outflow of gold would reverse, continued drains have reduced the U.S. Treasury gold stock to less than $19-billion—the first it has been that low since 1946.

The steady decline in gold stocks has been due to: (1) U.S. foreign and military aid, (2) increasing imports during the last decade, and (3) heavy private investments in foreign lands. These have not been offset by a large enough volume of exports, and an unfavorable balance of payments has resulted for the U.S. Foreign agencies holding credits in the U.S. can elect to take payment in gold—a privilege which all but U.S. citizens enjoy—and they have elected to do so since 1950, when the reversal of the U.S. international gold position started. Whenever U.S. fiscal policy adopts low interest rates to prime the domestic economy, the gold drain increases, because of foreign agencies' seeking higher-yielding investments abroad.

Two remedies have been suggested: (1) To discipline national spending, balance the budget and negotiate trade agreements that will cut down discrimination against U.S.-made products; and (2) increase the price of gold. Congressional records of Democratic and Republican Administrations since World War II have shown no sympathy whatever for an increased gold price. Opinions of financial advisors to government and industry are preponderantly against a higher gold price as a remedial measure, because it is considered to be deflationary and detrimental to the common good.

With the return of industrial prosperity to Europe and Japan, and the evaporation of the so-called world dollar shortage, it has been suggested that the U. S. be relieved somewhat of the heavy burden it has been carrying to help maintain the security of the Free World. Constant crises stirred up by Communistic troublemakers in two hemispheres appear to rule out any nearby cuts in government defense and security spending.

Now that gold is in the spotlight, the timing may be right for an attempt to bolster our dwindling domestic gold mining industry. As suggested in our January 1960 editorial, a subsidy for newly mined domestic gold would have the best chances for acceptance if the mining industry would lend unified support to such a plan.

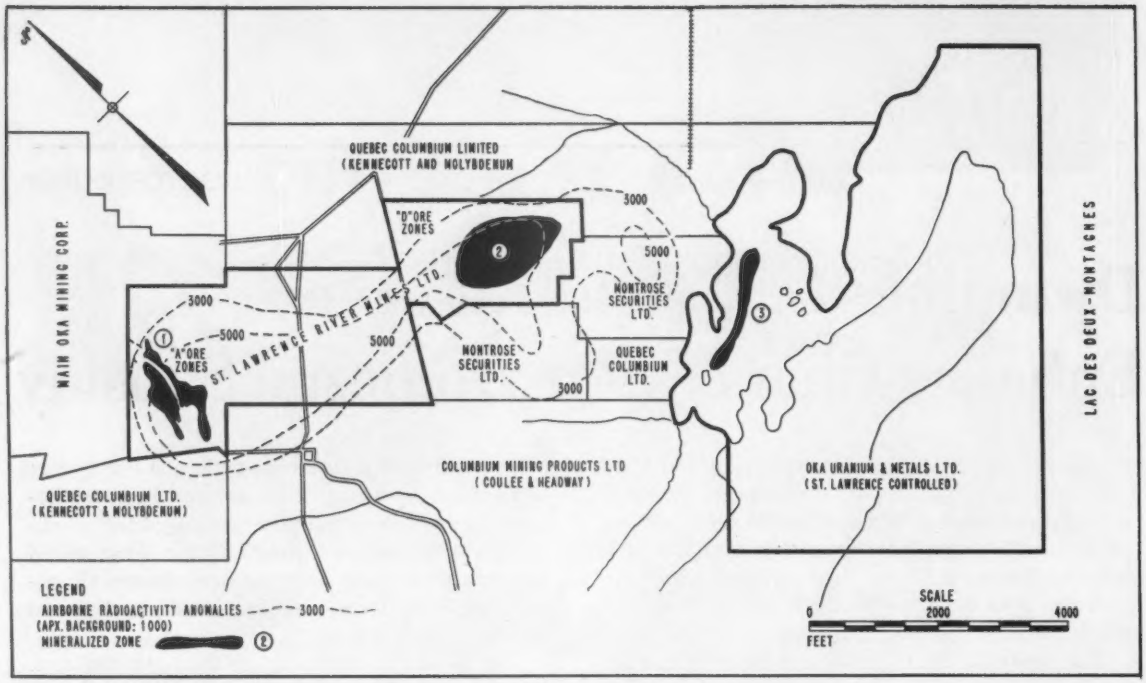
This is only a small step in the right direction. But if we have learned anything at all in the mining industry since World War II, it's this—to ask for too much from the Government is to get nothing.

Secondly, a program must be salable to Congress. A subsidy for gold offers these advantages:

1. With rising labor and material costs, it's questionable how long the $35 price for gold can be held. This means that the only way the price of gold can go in the future is up. Thus a subsidy now becomes an investment against the future.

2. The subsidy will go to the people who most deserve it—the miner and operator of gold mines. Lest anyone jump to the conclusion that a subsidy will boost profits for gold mines, we need only refer to the historical pattern of gold mining, which shows that when the price goes up, operators expand activities to exploit marginal low-grade ore blocks, thus boosting employment, capital investment and local business prosperity. In addition, many complex base-metal mines with by-product gold, in western mineral provinces, would get the added lift they now need.

3. Finally, let's not forget the shabby treatment which domestic gold miners got when the ill-advised, ineffective L-208 gold-mine closing order was put into effect in 1942. Gold production plummeted from a $170-million a year level to about a $35-million a year level, and has been limping along recently at a $60-million a year level. This took place when the Allies permitted gold production to proceed in Canada and South Africa, and Russia mined gold in Siberia with U.S. Lend-Lease equipment. We frankly think that the U.S. Government owes some type of retribution to the domestic gold mining industry, and that a subsidy would be the most effective and inexpensive direct help.



BLOCK A AND BLOCK D form the nucleus of the forthcoming mining operation, with first development to take place on Block A, where an open pit will go the 550 ft depth in the first stage. Oka Columbium is also held by the company.

Quebec's Columbium Will Be Tapped

A NEW SOURCE of high-grade columbium concentrate is now being readied in Quebec's Oka district, based on five firm foundations.

St. Lawrence Columbium & Metals Corp. expects to assail the growing columbium market with the happy combination of:

1) adequate reserves of pyrochlore;

2) an ore body which can be mined by economical open pit methods;

3) a successful metallurgical concentration process;

4) a premium-grade concentrate, with low contamination of tin or tantalum; and

5) proximity to power, transportation, shipping lanes and a good labor supply.

According to Jean-Joffre Gourd, president of St. Lawrence Columbium, a proven tonnage of 17.6-million tons of ore grading an average of 0.36% Cb_2O_5 exists in the Block A body, and the remainder of the company's holdings, including those of the subsidiary Oka Columbium & Metals Ltd., brings the total of proven and indicated ores to 62.6 million tons of marketable ore.

Drilling has taken place on the Block A, the Block D, and the Oka Columbium properties, but emphasis has been placed on the Block A, where mining will be undertaken first.

The concentrating process, which will follow the same layout and system as the company's successful pilot plant, is expected to result in production of three types of concentrate:

1) a table concentrate grading approximately 50% Cb_2O_5;

2) a flotation concentrate grading 50% Cb_2O_5;

3) a recleaned flotation concentrate grading 50% Cb_2O_5.

Company chemists, working in the laboratory, have tested a process that might produce a 90% Cb_2O_5 chemical concentrate, if it were demanded by special requests for purity.

The Block A ore body, which is the first to be mined, has disclosed the following reserves, based upon 67 drill holes totaling some 35,000 ft—17.6-million tons with a computed average grade of 0.36% Cb_2O_5. From that body, some 10.1-million tons of grade 0.45% could be mined, and approximately 7.8-million tons of 0.49%.

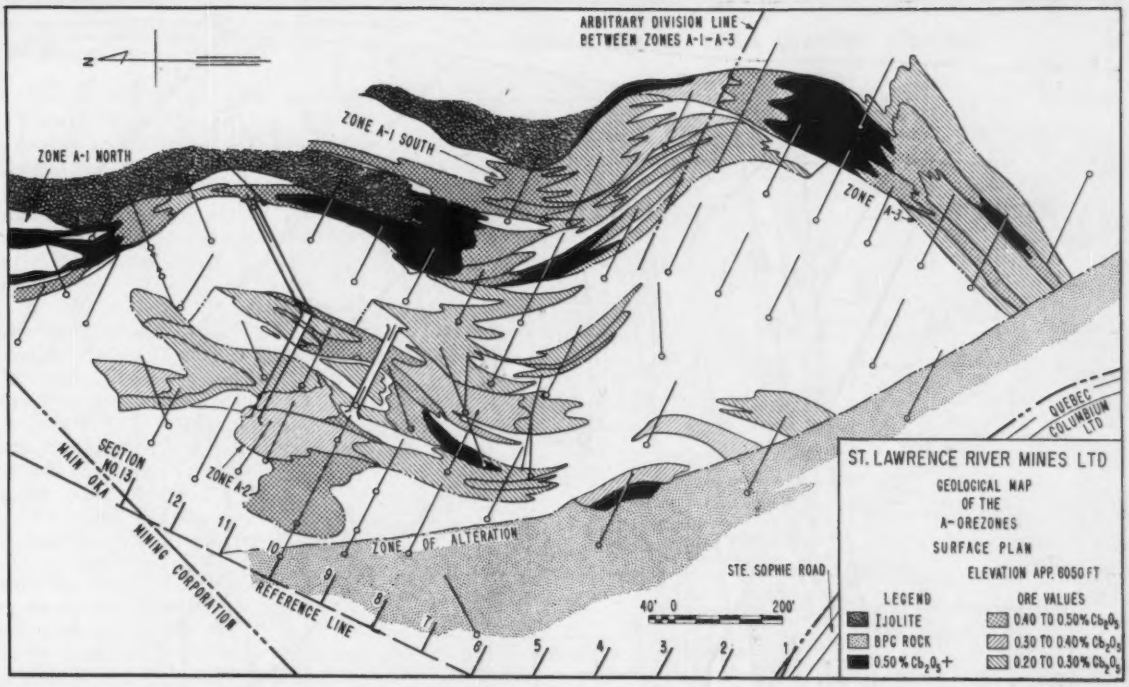
Based upon its drilling, St. Lawrence Columbium plans an open pit operation to 550 ft depth, with grades between 0.3% and 0.4%. It is believed the ore improves in grade at depth, but since the open pit will supply enough ore for many years, the company has not attempted to move an indicated 15-million tons under the proposed pit from the "indicated" into the "proven" class.

The Oka deposits (see maps) are located in farm country within 20 miles of the outskirts of Montreal, near the shore of Lake of Two Mountains, on the Ottawa River. Their proximity to the labor force in Montreal, to rails and waterways, and to power lines, is looked on as further encouragement to the development of a successful project.

Pyrochlore Dominates

On the St. Lawrence properties, columbium is found almost exclusively in the mineral pyrochlore. The pyrochlore occurs mainly as an accessory mineral in the carbonate rocks, with other subordinates such as magnetite, pyrite, biotite, apatite, olivine and pyroxene. Pyrochlore occurs also in minor amounts in the carbonate matrix of brecciated ijolite bodies.

The fact that pyrochlore contains small amounts of thorium and uranium, and thereby could be traced by radioactivity surveys, contributed to direction of the exploration program. In



SOME 17.6-MILLION TONS of ore, with an average grade of 0.36%, have been established in the "A" ore body. St. Lawrence River Mines, the name appearing on the drawings, was changed last month to St. Lawrence Columbium & Metals.

addition, magnetite frequently occurs with the pyrochlore, or is concentrated into lenses of carbonate rocks parallel to the columbium-bearing lenses. This phenomenon was also used extensively to trace the trend of the mineralized columbium-bearing rocks by magnetic surveys.

The pyrochlore of Block A, where most of the detailed analytical work has been concentrated, is known to contain between 55 and 60% Cb_2O_5, depending on the mineralized lenses. Tantalum content varies between 0.2- and 0.5% Ta_2O_5.

Some 66,000 ft of diamond drilling on the two principal areas of the property have disclosed the above tonnages for Block A; and for Block D, where 23,000 ft were distributed among 35 holes, approximately 13-million tons with a calculated average grade of 0.3% Cb_2O_5. (In all such calculations, and because of the lens-type deposition of the ore, much higher grades are found. For instance, in Block D's 13-million tons of 0.3%, grades up to 0.7% were encountered in an indicated tonnage of 1.1-million tons. Please see the accompanying drawings.)

St. Lawrence Columbium has a controlling interest in Oka Columbium and Metals Ltd. (see map), where 7,700 ft of diamond drilling in 14 holes indicated 25 million tons of 0.3% Cb_2O_5 again with a series of high-grade finds.

The geology of the deposits is described by the company as follows: "The columbium deposits of the Oka area occur in a complex of carbonate and alkaline rocks, which cut through Precambrian rocks of the Grenville series. These Precambrian rocks lie along a structural high (the Beauharnois axis), and are overlain by Paleozoic rocks of the St. Lawrence lowlands.

"The Oka complex has a maximum width of about one and a half miles, and extends northwesterly for four miles, in a direction that is at right angles to the general trend of the foliation and the diabase dikes in the Precambrian rocks. The complex is made of a complicated mixture of carbonate rocks and alkaline rocks of various types. The carbonate rocks similar to the Grenville limestones are banded, and at several places the banding is roughly parallel to the contacts of the Oka complex with the Precambrian rocks. A great diversity of alkaline rocks, not yet fully described, cut through the carbonate rocks as bodies of various shapes, or lie as lenses parallel to the foliation in the carbonate rocks; they are all unusual in composition, but include mainly rocks of the ijolite series, rocks of the jacupirangite series, and lamprophyric rocks. There is no doubt that carbonate rocks were mobilized and flowed after the intrusion of the alkaline rocks. Geologists familiar with the African carbonatites generally do not hesitate to consider the carbonate rocks of Oka as of magmatic origin. The structure in the central part of the complex is poorly or incompletely known, owing to the scarcity of exposures and the near absence of drill holes."

No date has been set for the beginning of actual mining, but the company management notes that exploration and development work has shown that the ore body in Block A could be worked economically at a rate from 500 tpd to 4,000 tpd, depending on the potential demand. Market studies by the firm are under way now to study that expected demand.

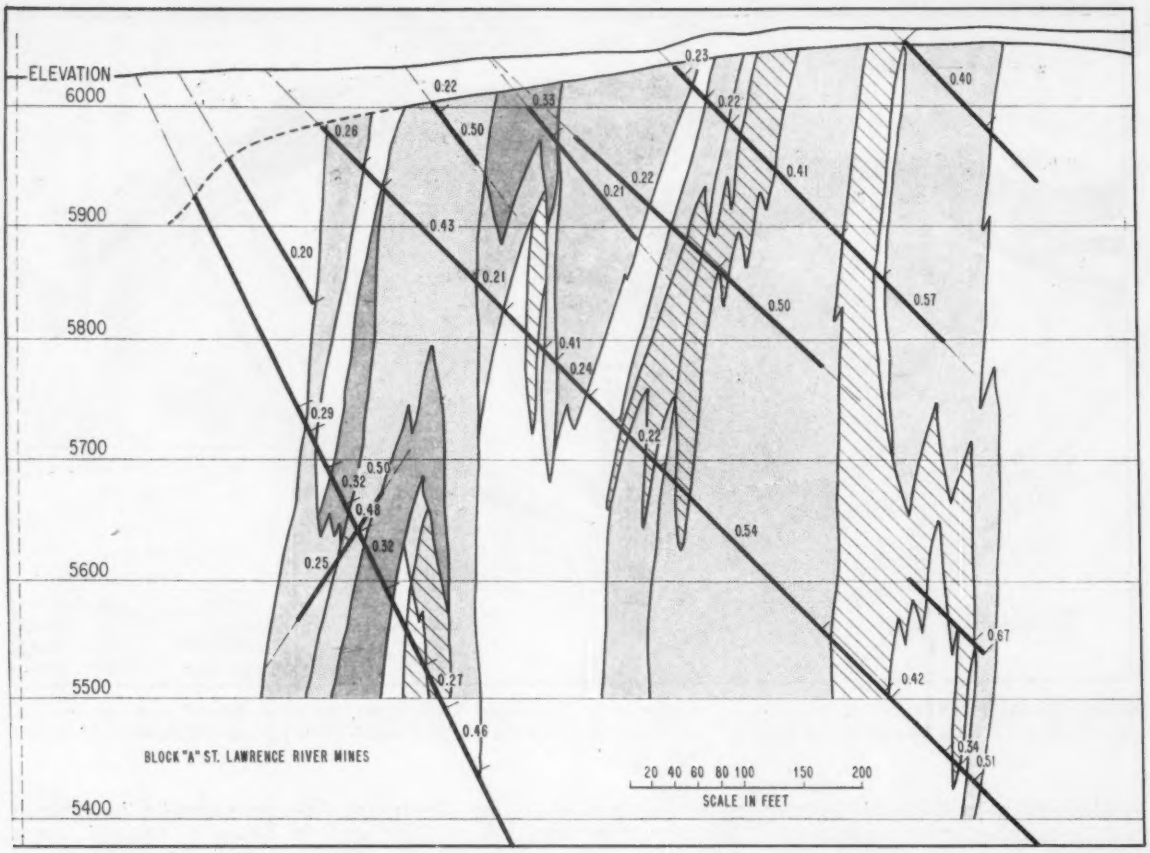
Patented Flotation Process

Separation and concentration of the pyrochlore consists essentially of mechanical-gravity separation, to remove the bulk of the gangue minerals, and upgrading by a unique "direct flotation" process, which was patented in Canada (and for which a patent will be issued shortly in the U.S.)

The company cites the following as an approximate composition of the ore:

pyrochlore	1.0%	magnetite	3.4%
calcite	75-80%	mica	3-4%
diopside	6-10%	pyrite	1-2%
apatite	3-4%		

Concentrates, according to Mr. Gourd, are currently assaying upwards of 54-55% Cb_2O_5, and are being



ALL ORE AVERAGES had to be carefully computed to provide an accurate reserve picture. Intrusions of various grades (see above and drawing on previous page) range well up to 0.7% Cb_2O_5. Other, and greater, reserves are indicated.

produced with over-all recoveries in "the 80% range" at the pilot plant; flotation recoveries vary between 97- and 98%. Some four years of research was conducted in the laboratories of l'Ecole Polytechnique, the faculty of applied sciences of the University of Montreal, by the staff of St. Lawrence Columbium & Metals. The Salt Lake City firm of Galigher Co. served as consultants and designed the pilot plant.

Ore in the pilot plant, after crushing to minus 20 mesh, is fed to a sand pump with water to produce a slurry. The slurry is pumped to a ton-cap type wire-cloth screen (48 mesh). The minus 48 product goes to an automatic sampler and then to Deister shaking tables. Oversize goes, via a rod mill, back to the wet screen. From the tables, a rougher concentrate of the heavier minerals, pyrochlore, magnetite, pyrite etc., is obtained; the major portion of the calcite and mica, representing about 75 to 80% of the feed weight, is washed to tailings.

The rougher concentrate flows to a wet-type magnetic drum separator, for removal of magnetite to tailings; the non-magnetic concentrate is thickened and run to pyrite flotation for removal of iron sulphides. Underflow from the cell is pumped to the calcite float circuit, where most of the calcite that had escaped the rougher tabling step is floated to tailings.

Underflow from the calcite float is passed over a first cleaner concentrating table for secondary removal of light minerals (mostly calcite), and recleaning of the concentrate takes place on a second table, providing a product in the 50% Cb_2O_5 range, depending upon the "cut" chosen. Tailings from this table are then taken to the pyrochlore flotation section. According to St. Lawrence Columbium, a plus-50% product results. Tests have shown the possibility of raising the grade at a reasonable additional cost, if customers requirements demand.

The St. Lawrence property was originally staked by a mining syndicate headed by Messrs. Gourd and Paul E. Riverin, mining engineer, both from Montreal. In early 1953, as part of a program of exploration of radioactive deposits, Mr. Riverin became interested in radioactive showings occurring on a magnetite prospect of three claims held by F. Manny of Montreal. On account of their findings and their interpretation of widespread radioactivity in the general surrounding area, in May 1953 the Gourd-Riverin syndicate started staking a large block of ground, which ultimately covered all of what is now known as the Oka complex, with the exception of a tract of land on which Trappist monks own the surface rights. In June 1953, Stephen Bond of the Molybdenum Corp. of America examined the three claims owned by Mr. Manny, and on his recommendation, the claims were purchased by his company, which also optioned and later purchased from the Gourd-Riverin syndicate an additional block of claims. The widespread radioactivity turned out to be due to thorium, and in lesser amounts to uranium occurring together with columbium in the mineral pyrochlore.

Although as early as December 1952 a member of the pyrochlore-microlite series was identified at the Geological Survey of Canada in a specimen sent by Mr. Manny, it was realized only in the spring of 1954 that the radioactivity and the occurrence of a columbium-bearing mineral were associated, and that valuable colum-

bium deposits might be present in the Oka area. The Gourd-Riverin syndicate then organized St. Lawrence.

Chicken vs Egg

Today's columbium market analyst is having a difficult time determining whether the gradually increasing demand for columbium is a result of the improved picture of known ore reserves, or whether the improved reserve picture is a result of increasing demand.

In his outlook for columbium (E&MJ, February 1960, p 126), William R. Barton of USBM noted that the future of the metal was "excellent," and that columbium-base alloys announced in 1959 "exhibited such excellent characteristics that utilization in various research and development programs began almost at once."

The major uses to date have been in nuclear, aircraft and space applications, according to Mr. Barton. Perhaps the most promising volume use of the metal is the steel industry, which has already introduced it in mild steels with unusually high strength, toughness and weldability. The first such use, by Great Lakes Steel Div. of National Steel Corp., used about 1 lb of Cb to the ton of steel. The use of columbium for stabilization of stainless steel is also reported increasing.

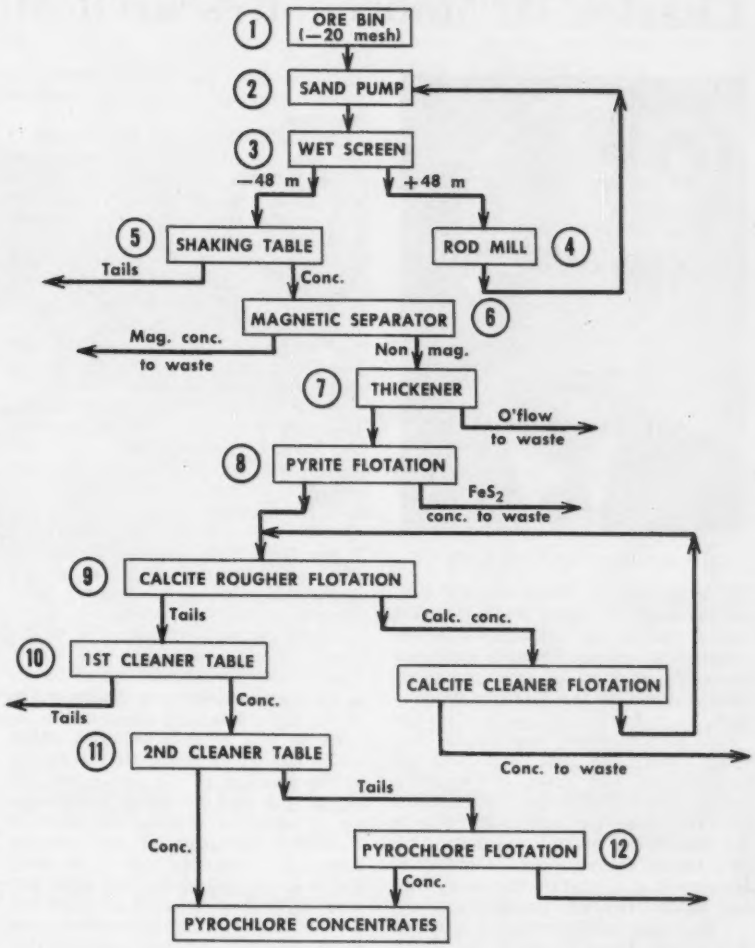
One forecaster sees columbium alloys being used for most of the 1900-2600 F structural applications in the early 1970's; and its possible applications in the nuclear field, due to high thermal neutron absorption and corrosion resistance, are considered great.

St. Lawrence Columbium & Metals Corp. estimates demand in the early '70's at around 23-million lb of Cb per year, based on a number of published reports. (Demand in 1960 is estimated at 2-million lb.)

Richard J. Lund, assistant technical director of Battelle Memorial Institute, in a speech before the Prospectors and Developers Assn. this year, took note of new pyrochlore discoveries and said, "We might look forward to an increase in total Cb usage of from 5 to 20 times its present total usage, in a period of 5 to 10 years."

The U.S. columbite market is presently slow but steady. Demand is running behind that in Europe. Observers look for the current situation to continue in the next few months. Prices are considered firm with high grade columbite (10:1 ratio) selling at about $1.25 a lb. c.i.f. U.S. ports. Metal of 8½:1 ratio is priced at about $1.10 a lb. Consumption is expected to pick up when the U.S. Government increases its purchases of columbium.

Pyrochlore Flotation, St. Lawrence Columbium & Metals Corp., Oka District, Quebec



LEGEND

1. Ore, crushed to approx. minus 20 mesh, is stored in bin.
2. From bin, it is fed to sand pump by means of electromagnetic feeder. Water is added to produce slurry.
3. Slurry is wet-screened through a toncap type wire cloth, 44-48 mesh openings.
4. Screen oversize is ground in rod mill, recirculated to sand pump.
5. Screen undersize passes through automatic sampler (not shown), then goes to Deister shaking table. Rougher concentrate of heavier minerals, including pyrochlore, magnetite, pyrite, etc., is obtained. Most lighter minerals, e.g., calcite and mica, representing about 75-80% of feed wt, are washed away and discarded.
6. Table concentrate goes to wet-drum-type magnetic separator. Magnetite concentrate is discarded.
7. Nonmagnetic pulp is thickened; thickener overflow is discarded.
8. Thickened pulp goes to pyrite flotation; pyrite concentrate is discarded.
9. Pyrite flotation tails, containing pyrochlore values, are pumped to calcite float circuit, where most calcite that escaped rougher tabling operation is floated off to waste. Calcite rougher concentrate is cleaned, cleaner tails being recirculated.
10. Rejects from calcite rougher flotation pass to first cleaner table. Light minerals, mainly calcite, are washed to waste.
11. Table concentrate is recleaned on a second table. Concentrate from this table ranges about 50% Cb_2O_5.
12. Second-cleaner-table tails are sent to pyrochlore flotation. Flotation concentrate grades 50% and above.

By recleaning, one-third to one-half of flotation concentrate can be upgraded, at reasonable cost, to 55%, remainder grading 50% and better. Alternately, table concentrates can also be floated to 55% grade, depending on customer's requirements; only inconvenience is somewhat higher reagent consumption.

Charles H. Moore—Research Means a Product

". . . with a view toward use."

"IN RESEARCH AND DEVELOPMENT even success can be a failure if a big project has a useless end product," says Dr. Charles H. Moore, newly appointed technical director of the non-profit Copper Products Development Association.

The easy manner of a university professor, which he once was, and the characteristic soft tones of Virginia's Shenandoah Valley, where he was born in 1915, belie the practicality that is the foundation of this researcher. To Dr. Moore the aim of the industrial laboratory is a product that sells. The end product is always in mind.

"We gather information on a material with a view toward its use in developing a product, not to add to the recorded data of it. Research-for-record purposes is not our job."

Dr. Moore enters his new post from a varied background in research. After earning degrees in geology and petrology at the University of Virginia and Cornell University, he began his career at the Carborundum Co. working on abrasive and refractory materials. From 1943 to 1945 he taught graduate studies at Pennsylvania State University. Then he joined National Lead Co., where he obtained patents on single-crystal titania gems.

For three years, concurrently with his work at National Lead, Dr. Moore held the chair of visiting professor, School of Ceramics, Rutgers University. In the fall of 1951, he joined P. R. Mallory & Co. as manager of its special metals division. By 1956 he was director of engineering and research, and in 1959 took on a special assignment as manager of the company's semiconductor operations. In previous positions he spearheaded research programs that led to corporate ventures into such diverse products as semiconductors, solid state devices, electronic components, special metals and alloys, brighter paint pigments, synthetic gems, and ceramic materials.

"Actually, I'm a jack-of-all-trades in the structure of matter," he points out. "The feel for the various disciplines blended in research is more important to a technical director than a heavy background in a particular field."

His membership in scientific and technical societies include: American Association for the Advancement of Science (Fellow); American Institute of Mining, Metallurgical, and Petroleum Engineers; American Society for Metals; the Electrochemical Society; American Ceramic Society; Newcomen Society; Keramos; Sigma Xi; Phi Kappa Phi; and Sigma Gamma Epsilon.

In August Dr. Moore became the first technical director of the Copper Products Development Assn., replacing the director pro tempore, Dr. Clyde Williams. The CPDA now has 25 copper-company members, representing mining operations in the U.S., Canada, South America, Africa, and Australia. These companies account for over 80% of the copper production of the world. Dr. Moore's job: to increase uses of copper in the world through new products. The scope: unrestricted.

Here's how projects will work. R&D, which Dr. Moore heads, reports directly to the president of the association, but works with two committees, one made up of technical experts, the other of marketing specialists of the member companies. First step will be to study the industry and make literature surveys to find an area of development. Two of the five research contracts now under way fall into this category. One of these has gone to the Southwest Research Institute on determination of increased uses for copper and copper alloys in the transportation industry. The other is an engineering survey on new uses for copper in the construction industry, awarded to Battelle Memorial Institute.

The second step is to come up with a specific research project and assign it to one of the commercial non-profit research laboratories or university foundations in America and abroad. Studies in this category are: development of tarnish-resistant copper by metallurgical surface treatment, also at Battelle; protection of copper by organic and inorganic films, now at the British Non-Ferrous Metals Research Assn.; and, the latest project, protection of copper by use of organic film, assigned to the Chase Laboratory.

Dr. Moore regards the development of stainless copper as the primary research job for the industry, and feels confident that it will come.

The five studies in progress highlight another philosophy of Dr. Moore's. R&D consists of two approaches. One is development engineering, in which known alloys are studied to find new products or new applications.

On the other hand is fundamental research, "where you hope to develop new copper alloys or metal compounds by changing the basic structure of copper."

"It's really a two-pronged attack," Dr. Moore explains. "We do minor expansion with quick results, while at the same time, we work on the big projects that make the news."

One problem confronts both these attacks. It is, simply, that most of the obvious uses for copper are known. In development engineering, Dr. Moore has set out to find the area in which a tailor-designed copper can come into the market. "The metal is there—find the use." In fundamental research, however, he is looking for a new material to fill a known use. The use is there—find the metal.

Dr. Moore announced that to aid in solving these problems the CPDA would work with other industries to coordinate research on products of mutual interest, as long as successful conclusion of the work will make new developments for copper. The main point is to get copper into the public eye and put it to work in areas where this metal is inherently better than any other.

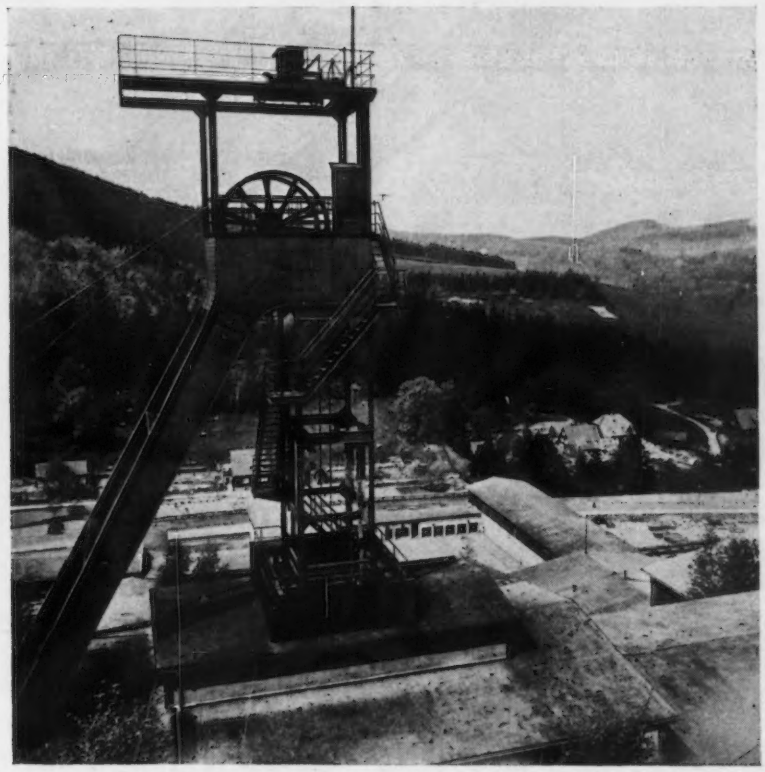
The technical director feels that the copper industry has to find new outlets for the large quantities of raw material coming out of the mines. One company could not do the industry-wide job of research required, so the association came into being, with costs shared by members on the basis of tonnage of production. In an association, unlike a private research laboratory, funds are not budgeted. The problem is to direct the association's money carefully into the proper channels.

"We should never place more projects than the association is capable of intelligently monitoring," says Dr. Moore, "no matter how much money is available."

Another different aspect of association R&D is that the director does not know his laboratories, nor the men in them, as he would in a privately controlled setup. To remove this hindrance, Dr. Moore's first task is to travel to the labs and get to know them, on the theory that "results are no better than the men working on them and the direction they receive."

In the meantime, the Moore family has moved into an apartment in Greenwich, Conn.; it is the first time the group has not occupied a home of its own. But with daughter Sandra Lee at college, son Charles Donald finishing high school in preparation for college, and Dr. and Mrs. Moore traveling, there are no plans for the present to get a permanent establishment.

Whatever the arrangement, one thing is sure. It will be practical.



FUNCTIONAL HEADFRAME DESIGN reflects 992 yrs of development at one of West Germany's leading lead-zinc producers. Ore reserves assure 30 more yrs.

Nearly 1,000 Years of Mining at Rammelsberg

JOHN B. HUTTL

THE LEAD-ZINC MINING OPERATIONS carried out today by the Unterharzer Berg-und Hüttenwerke GmbH at Rammelsberg, on the northern slopes of the Harz Mountains just south of the old Kaiserstadt (Emperor City) Goslar, are of interest to mining men all over the world, because of the complex ores mined and treated there successfully, and because the property still contributes a large share of the metallic lead and zinc produced in the Bundesrepublik (West Germany) after nearly 1,000 yr of continuous mining.

For instance, the nonferrous metal-mining industry of the Bundesrepublik in 1958 produced, from 2.2-million tons of raw ore, some 337,400 tons of concentrates containing 85,350 tons zinc and about 61,470 tons lead. About 44% of this production was obtained from the Harz metal mines. In the same year, West German smelters produced 187,000 tons zinc and 173,400 tons lead from domestic and foreign concentrates and by-product materials; of this the Harz smelter contributed 31% and 32% respectively. The ore reserves still available in the Rammelsberg mine assure a steady output of lead and zinc at these rates for the next three decades.

Discovery and actual mining of the Rammelsberg ore deposits dates back to 968 A.D. During the earlier life of the mine, the high silver content of the ores mined was of great economic importance to the country, as well as to the city of Goslar itself. Growth, prosperity, and welfare of the city always was and still is influenced by the fortunes of the mine. Copper, produced in conjunction with the silver, also was a much sought-after metal in those times. Later, production of lead overshadowed that of silver, and today zinc production exceeds that of lead both in quantity and in value.

The Saxon, Salian, and Staufen Emperors for more than two centuries looked upon the mine as their treasury. Since the emperor period, ownership of the property has alternately rested in the hands of the Dukes of Braunschweig, the city of Goslar, and the Kings of Hannover. After 1866 the holdings of the kingdom of Hannover were taken over by Prussia. Management of the property then lay in the hands of a Royal Control Board. This authority carried on until 1912, when the Königliche Oberharzer Berg-und Hüttenwerke, then brought into being, took over the active management of the mine and smelters. The company became a subsidiary of the Preussischen Bergwerks-und Hüttenwerke AG in 1924. Since 1925 operations have been directed by the Unterharzer Berg-und Hüttenwerke GmbH, in which Preussag has a 4/7 interest.

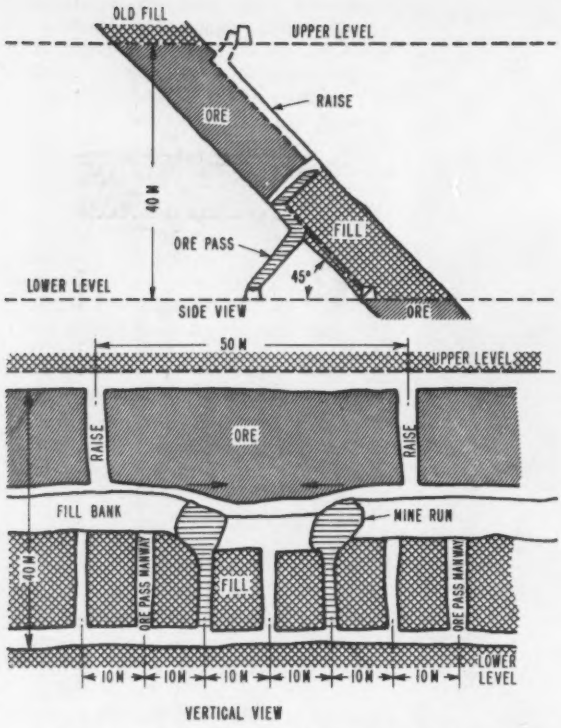
Ore Is in Sandstone and Slate

The geological formation in which the Rammelsberg ore deposit occurs is of Devonian age, and in the main consists of thick beds of sandstone and slate, badly faulted by the Variscan phase. They dip 45° to the southeast, as a flank of an overturned fold cut by a large fissure forming the northern limit of the Harz Mountains. The deposit consists of two main ore bodies—the Old and the New—embedded in Middle Devonian slate; and it dips about 45° to the southeast. Each ore body is some 500 m long on both strike and dip. Thickness averages 15 m, increasing in depth up to 50 m. The smaller lenses found near the main ore zones are of minor importance.

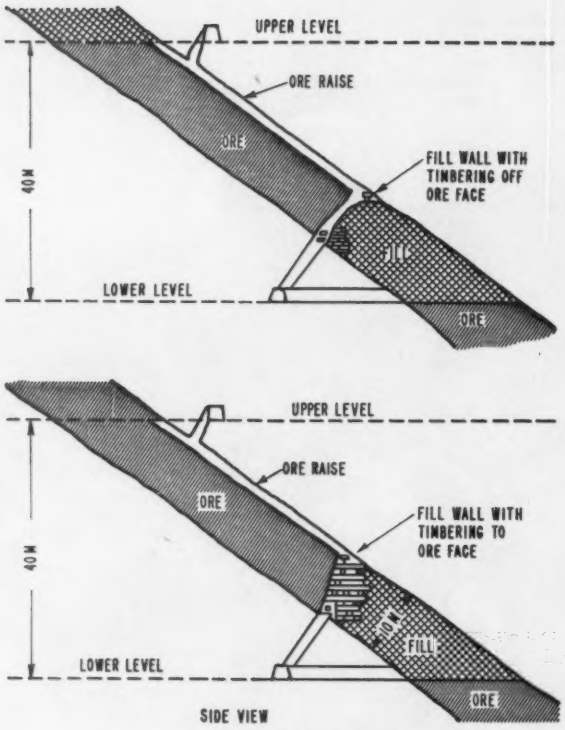
The main ore bodies are surrounded in places, chiefly in the footwall and in the east, by low-grade ore, locally known as "Banderz," consisting of alternating thin slates and layers of ore. It contains up to 3.5% lead; 0.5% copper; 7% zinc; and 6-8% iron.

The minerals found in the high-grade ore mined from the main deposit are galena, sphalerite, chalcopyrite, and pyrite. Gangue consists of barite and carbonate. The mineral particles range in size from a few to 60 microns, and are finely disseminated. Metal content is as follows: lead, 6 to 10%; copper, 1 to 1.5%; zinc, 15 to 20%; iron, 9 to 16%; barite, 20 to 25%; gold, 1 g/t; and silver, 160 g/t. The ore also contains small quantities of antimony, cadmium, bismuth, indium, thallium, and mercury. Lead and zinc contents decrease in depth, while those of copper and iron increase.

The main ore bodies contained about 22 million tons of ore, of which more than 16 million tons have been mined. Current ore reserves are es-

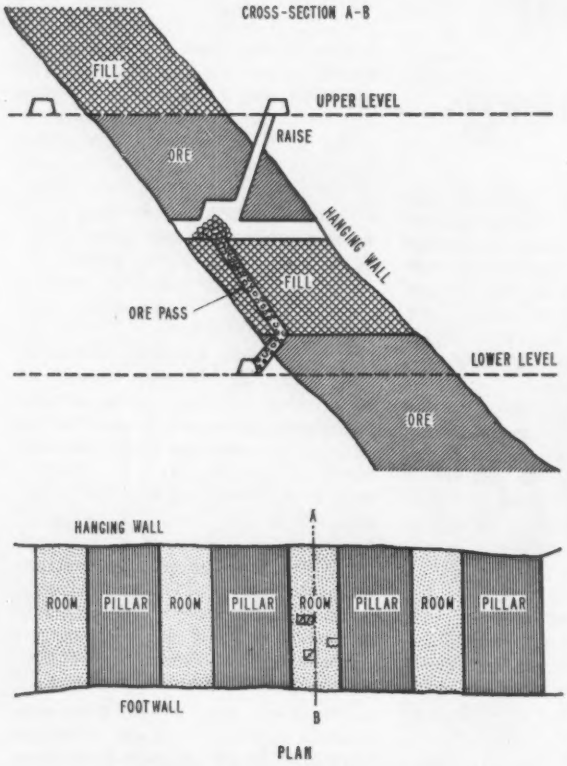


Filled Overburden Stope with Short-Spaced Ore Raises

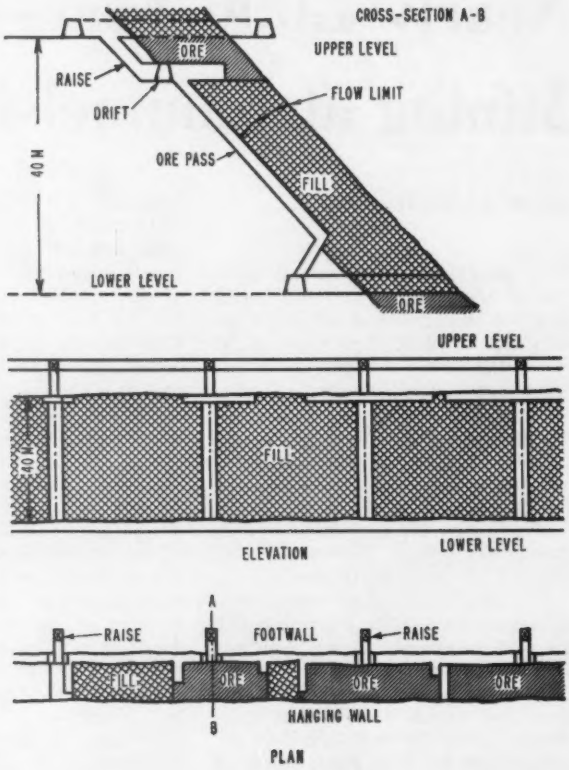


Normal Filled Overhand Stope

Stoping Methods Used in Rammelsberg Mine



Horizontal Cut-and-Fill Stope with Pillars



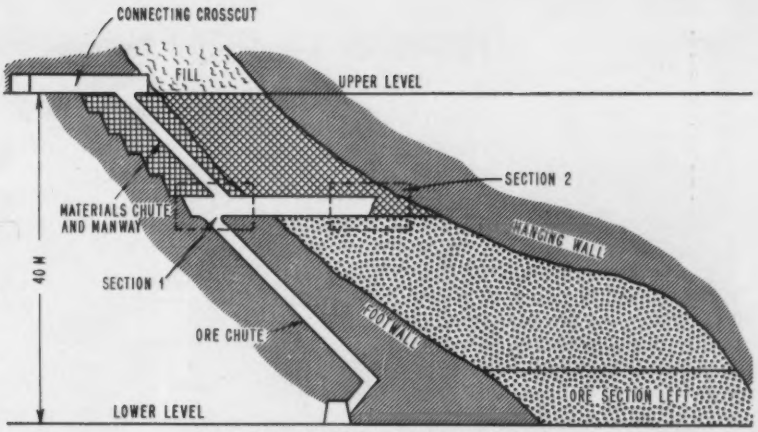
Crosscut System Stope

timated at 5 million tons of high-grade ore, and from 4 to 5 million tons of low-grade material. Exploration and search for new ore bodies continue.

Mining Methods Vary

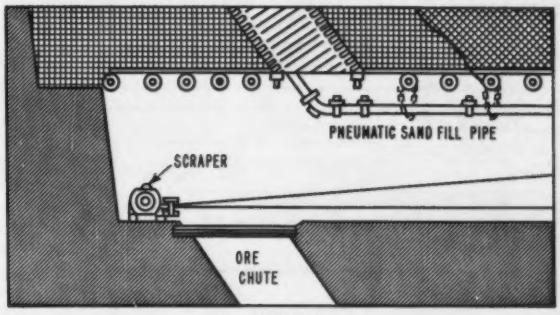
Current mine production exceeds 1,100 tpd. The main two-compartment shaft is a short distance from the crushing plant that serves the Rammelsberg 650-tpd mill. It is equipped with a modern steel headframe and hoisting plant. Mined ore is hoisted to the surface in 2- to 2½-ton cars. Developed ore in the upper sections of the mine is mined by filled overhand stoping and crosscut stoping, adapted to meet prevailing ground conditions. In the lower sections of the mine, where the ore is exceptionally wide, a combined method of cut-and-fill stoping and pillar stoping is applied.

Details of some of the stope layouts and pillar mining are illustrated. Drilling is done with airleg drills, and



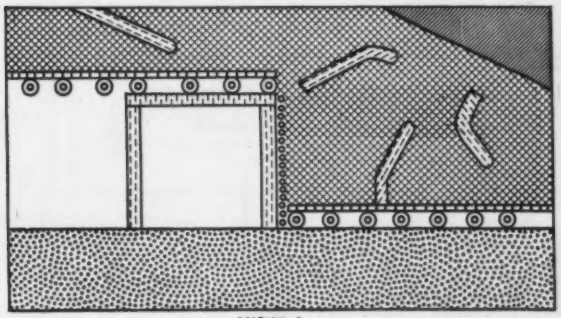
CROSS SECTION DURING MINING OF ONE SECTION

Pillar Stoping—Crosscut Mining in Descending Order



SECTION 1

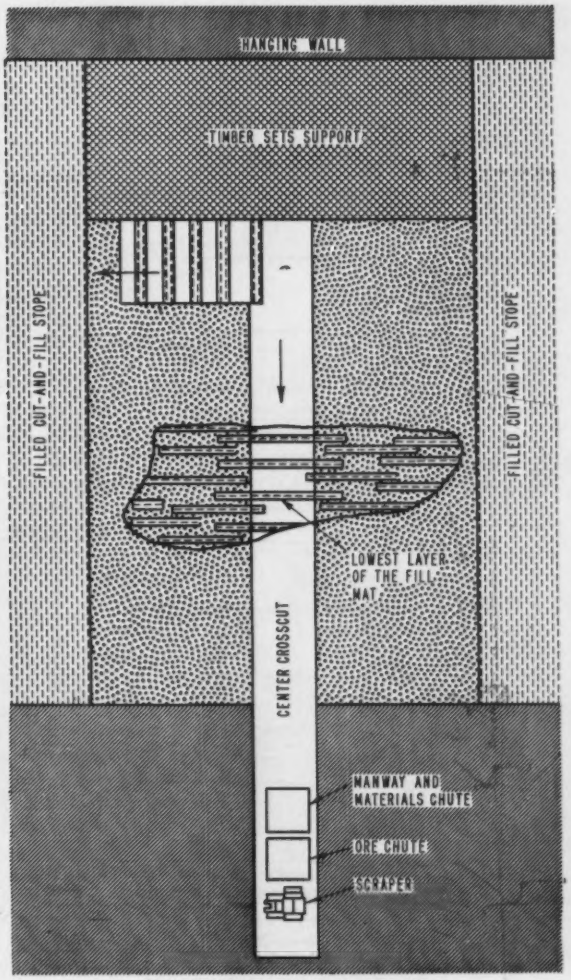
ENLARGED SECTIONS of drawing at top of page show how ore is extracted and upper area filled.



SECTION 2

PLAN VIEW at right shows the layout during the third phase of the downward mining cycle.

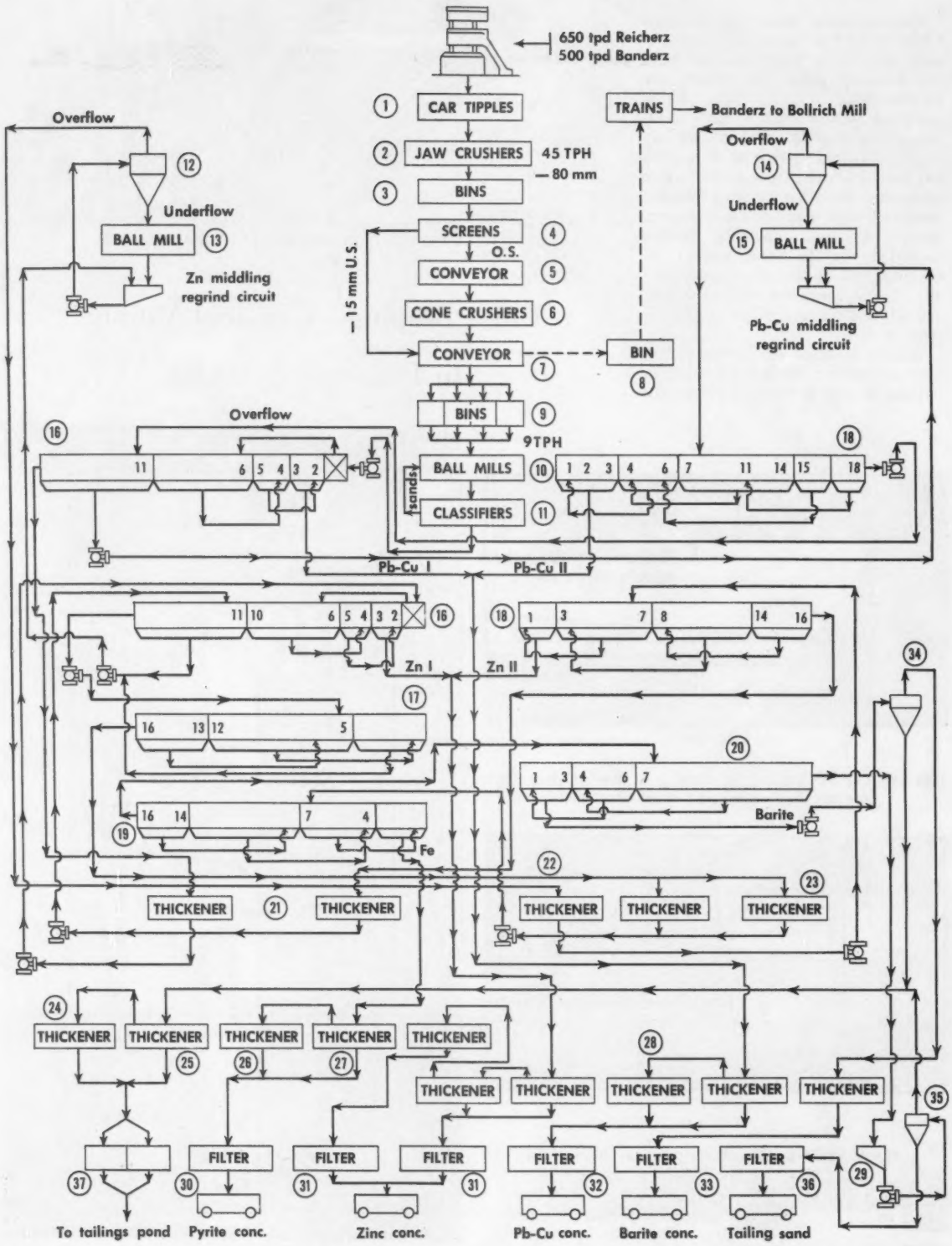
ORE
FILLED OPENINGS IN PILLAR
ROCK
FILLED OPENINGS IN FOOTWALL

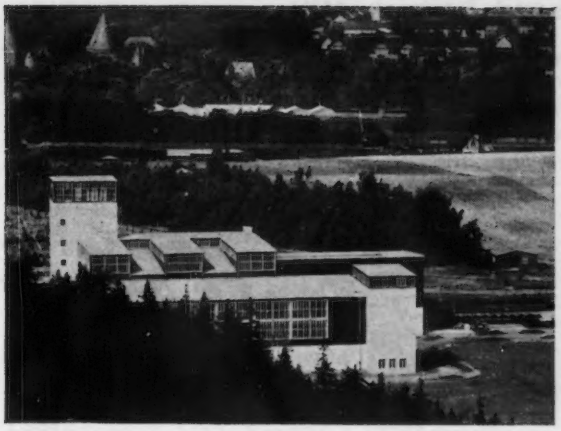


PLAN DURING MINING OF ONE SECTION

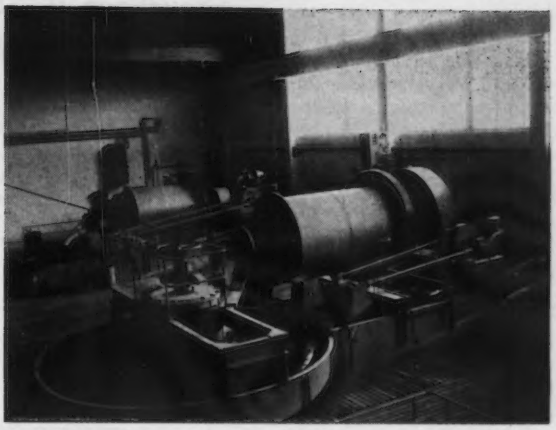
Flowsheet 1—650-tpd Rammelsberg Mill

High-Grade Ore Only





BOLLRICH FLOTATION PLANT handles 500 tpd of Banderz (low-grade ore), which is treated separately from higher-grade.



BALL MILL (foreground) is in closed circuit with a bowl classifier. Rod mill is in open circuit with a rake classifier.

LEGEND

1. Two revolving and one segment high-level car tipples
2. Three 400x700-mm jaw crushers
3. Three bins, each holding 100 tons
4. Three 2,500x1,000-mm vibrating screens
5. Three belt conveyors with magnetic pulleys
6. Three Symons No. 3 cone crushers
7. Belt conveyor system
8. 400-ton bin for Banderz only
9. Four fine-ore storage bins, each holding 270 tons
10. Three 1,800x3,000-mm ball mills (one standby)
11. Three Dorr DSFB bowl classifiers (one standby)
12. 350-mm hydroclone
13. 1,250x3,000-mm ball mill
14. 200-mm hydroclone
15. 1,250x2,500-mm ball mill
16. Rougher Pb-Cu and Zn flotation circuits, each made up of two 16-cell machines
17. Zn middlings flotation circuit, made up of two 16-cell machines
18. Cleaner Pb-Cu and Zn flotation circuits, made up of one 18-cell Pb-Cu machine and one 16-cell Zn machine
19. Pyrite flotation circuit, made up of two 16-cell machines
20. Barite flotation circuit, made up of two 16-cell machines
21. Two 14-m thickeners
22. 8-m thickener
23. Two 8-m thickeners
24. 15-m thickener
25. 20-m thickener
26. Two 5-m pyrite concentrate thickeners
27. Three zinc concentrate thickeners, 6m, 7.2m, and 12m dia.
28. Two 5-m Pb-Cu concentrate thickeners
29. 7-m barite concentrate thickener
30. Two Dorr drum filters and one Dorr internal filter
31. Four Dorr drum filters
32. Two Dorr drum filters
33. Two Dorr drum filters
34. 100-mm hydroclone
35. 350-mm hydroclone
36. Dorr internal filter
37. Mammutbagger installation

the monobloc drill steel, with tungsten-carbide insert bits, are manufactured and serviced in the mine shop. Gathering, loading, and tramming of broken ore are done mechanically wherever possible. Equipment employed includes scraper systems (some remotely controlled), mechanical shovels, and battery locomotives to haul trains to the shaft stations.

Milling Is Difficult

Beneficiation of Rammelsberg ore always has given difficulties, and its economical concentration first became possible by using flotation. The first flotation mill was built in 1936, following years of experiments.

Prior to the advent of flotation, copper ore, lead-zinc ore, and pyrite ore were separately mined, sorted, and screened on the surface. Copper and copper-free lead-zinc ores were treated in the company smelters, without beneficiation of the sulphur. The zinc was lost in the slag. Operations carried on in the original Rammelsberg flotation mill during the period 1936-42 were centered in treating lead-zinc ore only, the copper-lead-zinc ore being sent to the company's smelter at Oker as in the past.

Since then, the mill has received all ores mined. Lead-copper concentrates are reduced at the Oker smelter, and zinc concentrates at the Harlingerode zinc smelter. Zinc oxide plants, using old slags as feed, are operated at the Oker smelter and at the Herzog Julius Hütte. In addition to the different kinds of lead metals, the Oker smelter also turns out raw copper, cadmium, bismuth, metal salts and precious metals.

The low-grade or "Banderz," because of its different mineralogical composition, is treated in a separate mill, known as the Bollrich flotation plant, situated about 2.5 km from the Rammelsberg surface plant. It was placed in operation in June 1953, with a capacity of 500 tpd.

Screen Analysis of Rammelsberg-Mill Classifier Overflow

μ	%
+100	21.3
100-75	9.2
75-60	6.3
60-40	4.8
—40	58.4
	100.0

Screen Analysis of Bollrich-Mill Classifier Overflow

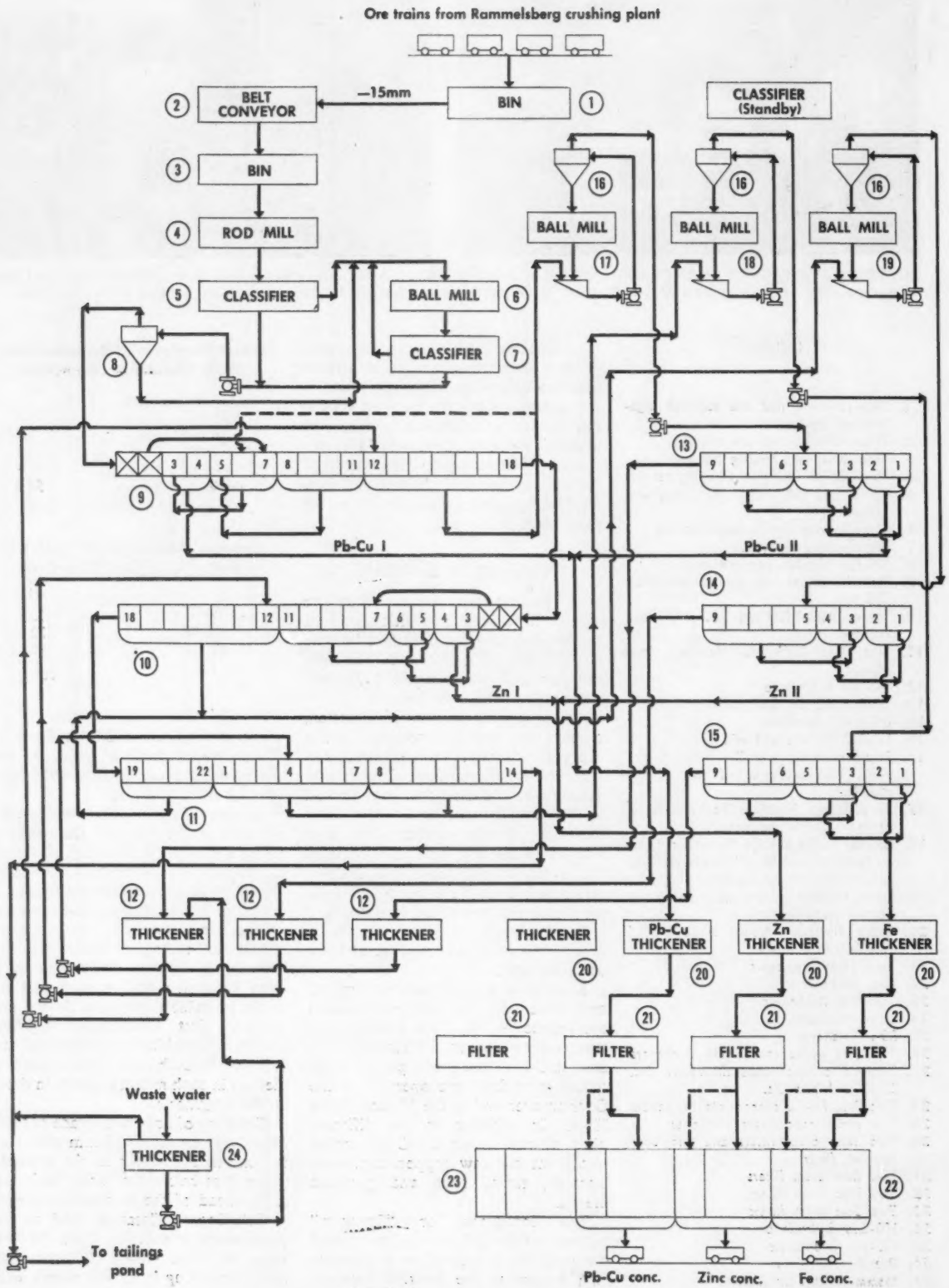
μ	%
+100	15.1
100-40	22.8
—40	62.1
	100.0

In view of the highly complex composition of the ores and the desire to effect a maximum recovery of metals, no marketable concentrates are produced. Additional treatment needed is given the concentrates at the company smelters mentioned. To get best separation of minerals, extremely fine grinding is required. Reagent setup in each flotation circuit is such that the easily floatable material is floated and removed first. Lead-copper middling and zinc middling are reground and refloated in both mills. Operations carried on in each mill are shown in detail in the flowsheets.

Crushing of both high-grade ore and "Banderz" to minus-15-mm mill feed is done in two stages in the crushing plant, just below the main shaft and at the head of the Rammelsberg mill.

Grinding to flotation feed at the Rammelsberg mill is done in one stage in three 1,800x3,000-mm ball mills, operating in closed circuit with

Flowsheet 2—500-tpd Bollrich Mill, "Banderz" Only



LEGEND

1. 100-ton slot bin
2. Belt conveyor
3. 400-ton storage bin
4. 1,800x2,500-mm rod mill
5. Dorr DSF rake classifier
6. 2,200x3,200-mm ball mill
7. Dorr DSFB bowl classifier
8. 350-mm cyclone
9. 18-cell Pb-Cu rougher machine
10. 18-cell Zn rougher machine
11. 18-cell pyrite rougher machine
12. Three 8-m thickeners
13. 9-cell Pb-Cu partial cleaner machine
14. 9-cell Zn partial cleaner machine
15. 9-cell pyrite cleaner machine
16. Three 100-mm hydroclones
17. 1,300x2,000-mm ball mill, Pb-Cu regrind
18. 1,300x2,000-mm ball mill, Fe regrind
19. 1,300x2,000-mm ball mill, Zn regrind
20. Four 6-m thickeners
21. Four Dorr drum filters
22. Four concentrate bins, each holding 300 m^3 dry concentrate
23. Four concentrate bins, each holding 150 m^3 wet concentrate
24. 15-m thickener

Dorr DSFB bowl classifiers. The mills operate at 23 rpm (70% of critical speed), and rate of feed is 9 tph. Ball load is 12 tons, made up of 80-, 60-, and 40-mm steel balls. Liner consumption varies from 45 to 70 g/t, depending on the type used, and consumption of balls is about 530 g/t.

Classifier overflow, or flotation feeds, is adjusted at 900 g/l solids, with a fineness of 55-60% minus 40 microns.

The flotation department contains four circuits: (1) lead-copper; (2) zinc; (3) pyrite; and (4) barite. Both the lead-copper and the zinc circuits consist of two machines with 12 or 16 cells each for main flotation, and one machine with 16 or 18 cells for re-treatment. The third circuit is made up of two banks of 16 cells each for recovering a zinc middling product, and two machines with 16 cells each for pyrite and residual sulphides.

Two machines are available for recovery of barite from the sulphide tailings, which contain from 40 to 50% $BaSO_4$. Final concentrates produced assay 94-95% $BaSO_4$.

Pulp is thickened between the circuits. Flotation machines include Denver, Rheinhausen, and Wedag types; cell capacities are 1,000, 1,500, and 2,800 liters. Mine-run ore treated in the Rammelsberg mill contains 8% lead, 17% zinc, 1.0% copper and 11% iron.

The lead-copper circuit is operated as follows: In the first cells of the main flotation machines, lead and copper minerals are floated; and after two-stage cleaning, the final concentrate goes successively to a thickener and a drum filter. The froth from the last cells contains lead-copper-zinc middlings. These are treated in a separate regrind unit, which consists of a ball mill operating in closed circuit with a hydroclone.

Reagents used in the main flotation section include ethyl xanthate (96 g/t), hexyl xanthate (48 g/t), NaCN (2 g/t), $ZnSO_4$ (1,010 g/t), $NaHSO_3$ (165 g/t), and tragol, a beechwood tar oil (83 g/t). The pH is about 7. The final concentrate assays 34.5% lead, 16% zinc, 3.5% copper and 14% iron. Recoveries of lead and copper in the final concentrate are 68.5% and 61.0% respectively.

In the zinc circuit the rougher concentrate is cleaned, recleaned, thickened, and filtered. Middlings are reground and classified in a ball mill-hydroclone installation, similar in design to that serving the lead circuit.

Reagents used are butyl xanthate (125 g/t), NaCN (40 g/t), $CuSO_4$ (650 g/t), CaO (500 g/t), and pine oil (25 g/t). The pH is maintained at 9. The final concentrate averages 44.2% zinc, 6.1% lead, 1.0% copper, and 9% iron. Recovery of zinc in the final concentrate is 80%.

In the pyrite circuit a final concentrate is obtained after two-stage cleaning; it assays 30.5% iron, 4% zinc, 2.3% lead and 0.6% copper. Because of the zinc, lead, copper, and precious metals contained, the concentrate is shipped, together with the lead-copper concentrate, to the Oker smelter.

The final tailings, which assay 0.7% lead, 0.6% zinc, 0.06% copper and 5% iron, are separated into a sand product, for mine fill, and a slime product. The latter is thickened and pumped by Mammouth-Bagger pump through a 4.5-km pipe line to the tailings disposal area.

Treatment of Banderz at Bollrich Mill

As mentioned before, the 500-tpd Bollrich mill handles "Banderz" exclusively. Mill heads assay 4.4% lead, 8.1% zinc, 0.4% copper and 7.8% iron.

The minus-15-mm ore, brought in trains from the Rammelsberg crushing plant, is dumped into small bins, from where it is belt-conveyed to a storage bin at the head of the mill. Grinding to 62% minus 40 microns is done in two stages. The equipment that does this work consists of a rod mill, in open circuit with a rake classifier, and a ball mill, in closed circuit with a bowl classifier. Recently, a third grinding circuit (not shown) has been added to treat classifier overflow. It consists of a ball mill and a hydroclone.

Flotation feed, or classifier overflow, contains 600-650 g/1 solids. The rod mill is operated at 19 rpm (60% of critical speed) and contains about 11 tons of 80-mm rods. Feed rate is 21 tph and installed power 125 kw. The ball mill operates at 23 rpm (75% of critical speed), and ball load consists of 15 tons of 40- and 25-mm steel balls. Installed power is 185 kw.

Three Flotation Circuits

The three circuits operated in the flotation section of the mill are lead-copper; zinc; and pyrite, with residual sulphides. Each circuit employs an 18-cell machine for main flotation and nine cells for re-treatment. All cells are of Humboldt manufacture, each with a capacity of 1,500 liters. In each circuit the froth discharge of the first cells, after two-stage cleaning, is the final concentrate. The middlings from the last cells are classified, reground, and refloated for production of another final concentrate.

Reagents used in the lead-copper circuit are ethyl xanthate (180 g/t), hexyl xanthate (90 g/t), NaCN (10 g/t, $ZnSO_4$ (1,175 g/t), $NaHSO_3$ (300 g/t), and tragol (130 g/t). The concentrates contain 32.8% lead, 16.6% zinc, 2.5% copper and 13.9% iron. Recoveries of lead and copper in the final concentrate are 69.4% and 63.5% respectively.

Reagents used in the zinc circuit include butyl xanthate (180 g/t), NaCN (60 g/t), $CuSO_4$ (920 g/t), CaO (725 g/t), and pine oil (35 g/t). The concentrates assay 44.3% zinc, 5.3% zinc, 0.6% copper and 7.7% iron. Recovery of zinc in the final concentrate is 71.5%.

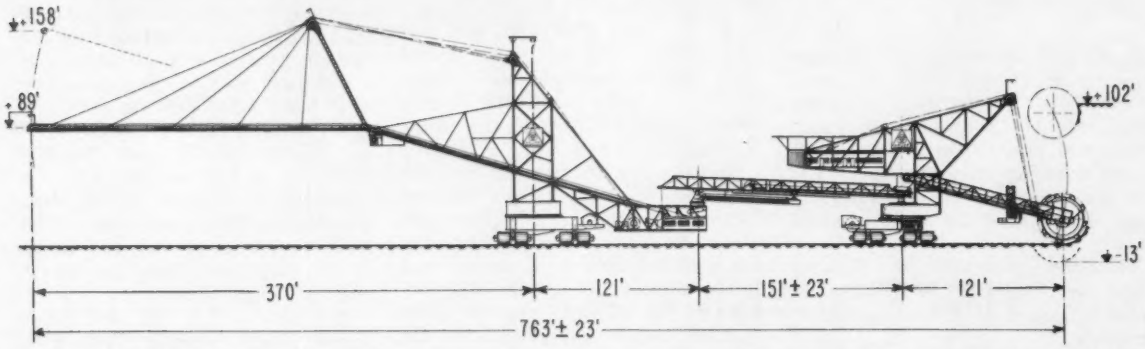
Reagents used in the pyrite circuit are ethyl xanthate (120 g/t), hexyl xanthate (60 g/t), and tragol (125 g/t).

Final tailings contain 0.6% lead, 0.5% zinc, 0.05% copper and 5.4% iron.

The cakes produced by the drum filters are dumped into respective bins, where they are removed and loaded into standard-gage railroad cars for shipment to the company smelters.

E&MJ wishes to thank Bergrat a. D. Dr.-Ing. eh Paul Ferdinand Hast of Unterharzer Berg-und Huttenwerke GmbH, Goslar, for his permission to publish this article. The many courtesies shown during visits to the mine and plants, and the help in gathering information given by Bergassessor a. D. Wolfgang Huber and Bergwerksdirektor Dipl.-Eng. Ernst Krause, are deeply appreciated and acknowledged.

THIS BUCKET WHEEL excavator with connecting bridge and boom works a 13-ft-thick lignite deposit at Arjuzanx, France, after stripping off 100 ft of overburden. The removed earth is dumped into the worked-out area of the open pit.



DIAGRAMMATIC SKETCH of the bucket wheel and boom stacker indicates how the crawler-mounted conveyor bridge links the excavator with loading equipment. This arrangement permits the excavator and loader to slew independently.

Bucket Wheel Is Versatile Excavator

SCHEDULED FOR DISPLAY at the Mining Show in Las Vegas is a small bucket wheel excavator manufactured in West Germany by Fried. Krupp Maschiner- und Stahlbau Rheinhausen. This model, designated type Sch Rs 100/0.4, 9.5, has an output up to 470 cu yd per hr of loose material, and can work continuously.

Adaptable Uses

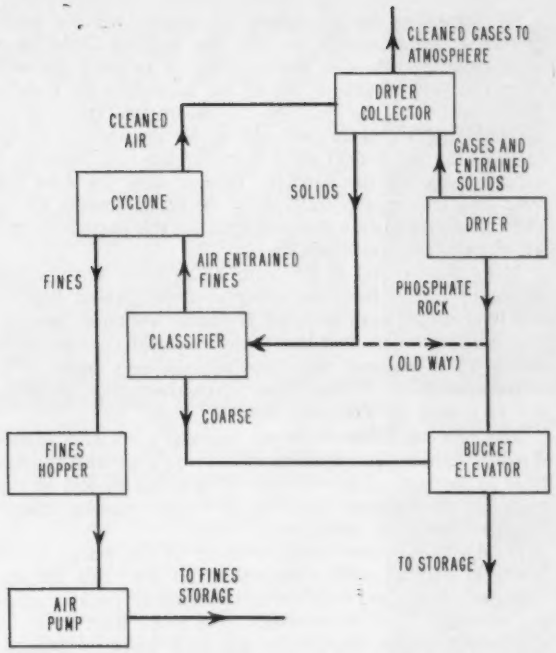
Bucket wheel excavators are sold in Europe and Australia for removal of overburden and mining of brown coal by open pit methods. The building industry uses similar equipment for various earthmoving jobs, including excavating cuts and canals and digging routes for highways and railroads.

The rotary digging tool, the bucket wheel, carries out a more-or-less horizontal slewing motion, and is suitable for selective mining of stratified deposits in layers of varying thickness. The digging tool, which does the excavating, is a wheel with six to twelve buckets on its periphery. Conveyor belts economically transport the material away from the buckets.

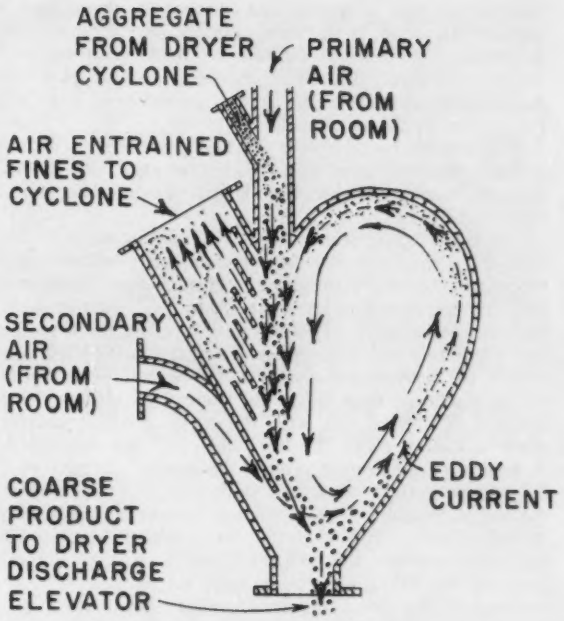
The continual digging process reduces specific power requirements, and the even load imposed on the continuously working excavators during the cutting operation reduces maintenance and repair. In the case of small bucket wheels, an independently slewing belt boom loads the excavated material. On large-capacity bucket wheel excavators, the material discharge is moved on an independent mobile loading plant, a crawler-mounted unit that can travel independently of the parent machine. A movable conveyor bridge links the excavator with the loading equipment, giving large-capacity plants stripping widths of over 300 ft.

Continued Development

Since the early 1930's Krupp has developed bucket wheels ranging from 90 cu yd per hr to excavators with an output of 200,000 cu yd per day and cutting heights of 250 ft. At present, excavators and conveyors are working under severe climatic conditions in Canada, South Africa, America, Australia, India, the Congo, and Europe. Advantages of the bucket wheel, says the manufacturer, are its versatility in operation and low specific working costs.



MINUS 100 MESH phosphate from the new classifiers is reclaimed by a cyclone. With the new system, about 2 tons of fines per hour are separated from the coarse.


AGGREGATE FROM DRYER CYCLONE
PRIMARY AIR (FROM ROOM)
AIR ENTRAINED FINES TO CYCLONE
SECONDARY AIR (FROM ROOM)
EDDY CURRENT
COARSE PRODUCT TO DRYER DISCHARGE ELEVATOR

EDDY CURRENT provides a moving wall containing the curtain of feed material in the classifying zone without the detrimental frictional effects of a solid wall.

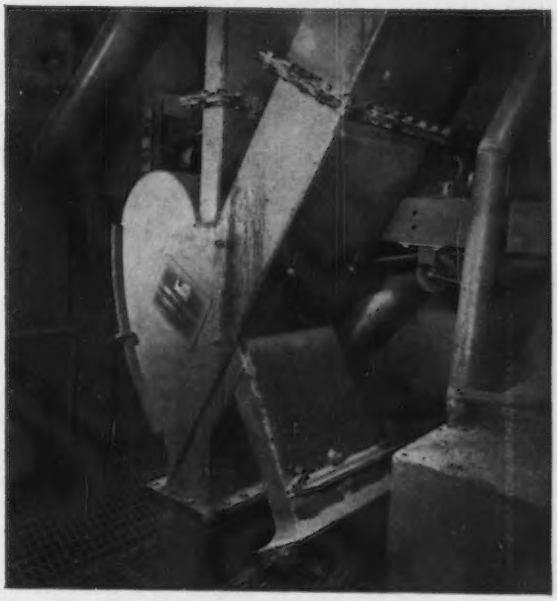
New Air Classifiers Reclaim Phosphate

AMERICAN AGRICULTURAL CHEMICAL CO. has recently put into operation two new high-efficiency air classifiers to separate fines from phosphate rock at its processing plant in Pierce, Fla. Advantages gained are threefold: (1) Sufficient phosphate fines are now being reclaimed to pay for the new units in less than a year. (2) The installation has eliminated a long-standing dust problem. (3) An important high separation efficiency (95%) is realized.

The dust difficulties at the plant resulted from dumping minus 100 mesh fines into the same silos as larger particles. Phosphate rock larger than 100 mesh settles readily and creates no dust problem, but much of the 100 mesh material rises into the atmosphere and is lost. It was to separate the minus 100 mesh material from the aggregate and enable its independent collection that the new classifiers were installed.

High separation efficiency was desired because the presence of fines decreases the value of the coarse and, at the same time, any coarse carried away with the fines would be disposed of at less than its full economic value. Also, excessive coarse material in the fines would hamper the operation of the pneumatic handling system used to transfer fines from the classifier to storage. The fines are now stored with a finished milled product.

Each classifier processes the solids collected by a group of cyclones which cleans the exhaust gases of a rotary dryer. There are two dryers, each served by an independent group of cyclones, and solids from each group are conveyed to the respective classifier by screw conveyor.



COMPACT CLASSIFIER has high efficiency and no moving parts. Power is supplied by the cyclone fan motors. The cut point may be varied by regulating the air supply.

A schematic diagram of the classifier is shown above. Phosphate rock and room air enter at the top through a vertical inlet duct and travel downward. Particles larger than 100 mesh discharge from the bottom of the unit into the bucket elevator system which handles phosphates from the dryer. Minus 100 mesh material is drawn off through an inclined duct at one side of the classifier. It travels upward into a cyclone which separates the par-

ticles from the airstream and discharges them into a hopper. The hopper in turn empties into a pneumatic conveying system which delivers the fines to an enclosed storage bin. Cleaned air from the Buell cyclone goes into the gas exhaust ducts of the dryers. Coarse material is sent via a dryer discharge elevator to storage.

The over-all result is that the coarse material is stored in open, dust-free bins, while the lighter particles—instead of being discharged into the air and wasted—are stored separately.

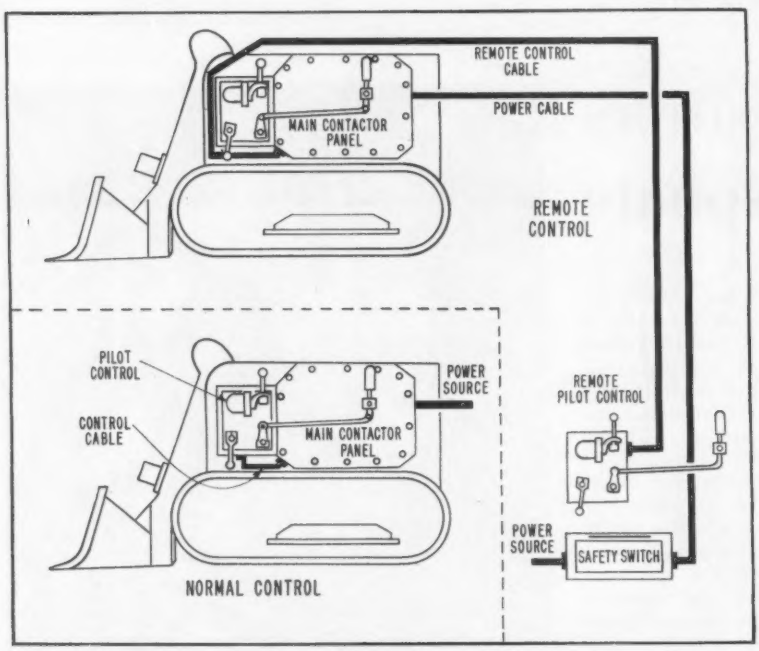
The Buell "gravitational-inertial" classifiers separate the fines from the feed material by controlling aerodynamic forces in a way not used before in classification. As shown, the entering airstream makes a sharp "U" turn into the inclined discharge duct shortly after entering the classifier and simultaneously sets up a counter clockwise eddy current in the body of the classifier. The vanes at the mouth of the discharge duct aid in the control of airflow. Fine material is carried out with the airstream, but coarser material cannot make the turn and continues downward. A secondary air supply crosses the coarse material near the bottom outlet and scrubs away any fines adhering to the larger particles. The secondary airstream, reinforcing the eddy current, travels around the inside of the classifier and exits through the exhaust duct. The eddy current provides a moving wall containing the curtain of feed material in the classifying zone without detrimental frictional effects of a solid wall.

By regulating the secondary air supply, the cut point is varied. Air is drawn through the inclined outlet duct at a constant rate and the velocity of primary air will therefore vary in proportion to the secondary air supply. The velocity of the primary air determines the size of particle which will or will not make the turn into the inclined discharge duct since it determines the downward inertial force on the particle. To exit with the fines the inertial force on a particle must be small enough to be overcome by the drag force exerted on the particle as the air stream changes direction.

More than 8,000 lb of material an hour is delivered to the classifiers from the dryer cyclones. About half of this is plus 100 mesh and half is minus 100 mesh. Separation is so complete that the coarse material contains only about 5% fines and the fines contain only about 6% coarse material. Further, the respective stray particles are very near the cut point size.

The new classifiers have no moving parts and consequently, require almost no maintenance. They also require little in the way of power—merely the fan motors at the cyclones. No operator attention is needed once the classifier is set for given conditions.

Until the classifiers were installed at the plant, up to 4,000 lb of fines were discharged into the main storage bins every hour, and much of this was lost to the surrounding atmosphere. It is estimated that more than 95% of the formerly lost phosphates are now being reclaimed.



LEAD WIRES from either the machine pilot control or the remote pilot control can be plugged into the main contactor panel, depending on the desired operation.

Remote Control Loader

RICHARD HAYS

Mr. Hays is mine engineer on the remote controlled loader with the Uranium Div., Calumet & Hecla Inc., Grants, N.M.

TO OBTAIN NEARLY 100% EXTRACTION during the retreat phase of mining at the Marquez Mine, Uranium Div. of Calumet & Hecla Inc., the problem of loading the broken ore, without exposing personnel to the weak roof conditions, had to be solved.

George McKereghan,* mine manager (at that time), suggested the idea and performed the initial investigation of a remote controlled loading machine, which would allow loading broken ore next to the cave area, and to recover ore from blasting entire major pillars—no prior splitting up.

Loader Eliminated Need for Roof Support in Selected Areas

Then ore occurs in a highly crossbedded, poorly cemented, structurally weak sandstone with shale lenses, overlain by a shale member. Normal roof support consists of rock bolting and timber sets. To cut costs with no decrease in safety and still provide for nearly complete extraction without the cost of roof support in selected areas, the need of a remote controlled loading machine was deemed absolutely necessary.

The primary loading machines used in the development and initial production of the Marquez Mine were the Eimco Corp. 630 electric loaders. Through the cooperation of Lester Hanson and Richard Wilbins of Eimco, a general plan for converting the Eimco 630's to remote operation was formulated.

* Mr. McKereghan is presently on special assignment at the Calumet Div. of Calumet & Hecla Inc. R. W. Kliebenstein is now mine manager.

The control of the traction motors and the bucket hoist motor is by rotary drum switches located within a pilot control panel separate from the main contactors and auxiliary circuits. By installing a separate remote pilot control panel with the appropriate lead wires, the loader was "ready made" for remote control operation.

The ability to operate the loader in its normal condition as well as remote control was a definite factor in the final design. The change from remote operation to normal operation at the machine had to be accomplished without the delay of making lead wire changes or having to open up the panel covers.

Walter E. Zenz, master mechanic at the Marquez Mine, was responsible for the fabrication of the remote station and modifications of the loaders. There are ten control lead wires which normally pass between the pilot control panel and the main contactor panel, and join at a terminal strip within the main contactor panel.

Plug Receptacle Eases Change

The system developed was to bring the ten lead wires from the main contactor panel out to the surface terminating in a plug receptacle. Then lead wires from either the machine pilot control or the almost identical remote pilot control could be plugged into the main contactor panel depending on the mode of operation desired.

The remote control cable is a 12-conductor, No. 14 Simplex control cable. The two additional conductors in the remote control cable are used as ground wires.

In addition to the remote control cable, a power cable had to be carried along with the remote control cable from the remote station to the loader. The power cable is a three-conductor, No. 4G Simplex-Tirex portable cable for 460-v, 60-cycle, three-phase operation. Both power cable and remote control cable are rated at 600-v insulation.

The standard connectors, presently in use, are manufactured by the Joy Mfg. Co. The Joy connectors are used on both the power cable and the remote control cable. Because of space limitation and ease of handling a combination of a five-conductor connector and six-conductor connector was selected over a single 11-conductor connector. Minimum requirements are ten control leads and one ground lead.

The remote pilot control panel, main power safety switch, lighting transformer and two floodlights are mounted on a skid-mounted platform at the remote control station. The traction motors control lever and the bucket operation lever are in the same relative position as found on the loader. This was to make the transition as easy as possible for the loader operators. Remote operation of the loader then becomes almost identical to that of direct machine operation—same hand movements for direction and bucket operation. Two distinct problems arise with remote operation: First, the loss of feeling of motion of the loader, which makes for rougher treatment of the loader; secondly, the cable handling problem.

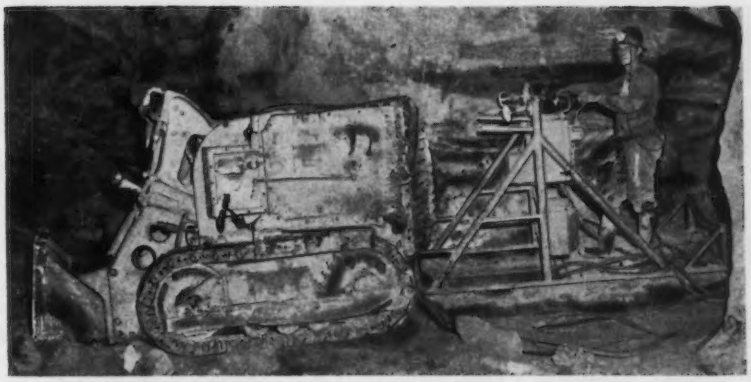
In this particular mining operation, the loading time is relatively short and movement of the loaders is frequent, so that extensive cable handling systems such as serpentines, etc., would be uneconomical and probably unsafe to install under the conditions. A cable reel with sufficient slip-rings would be too bulky to handle easily.

During the periods of remote operation, an extra man is required to handle the cables.

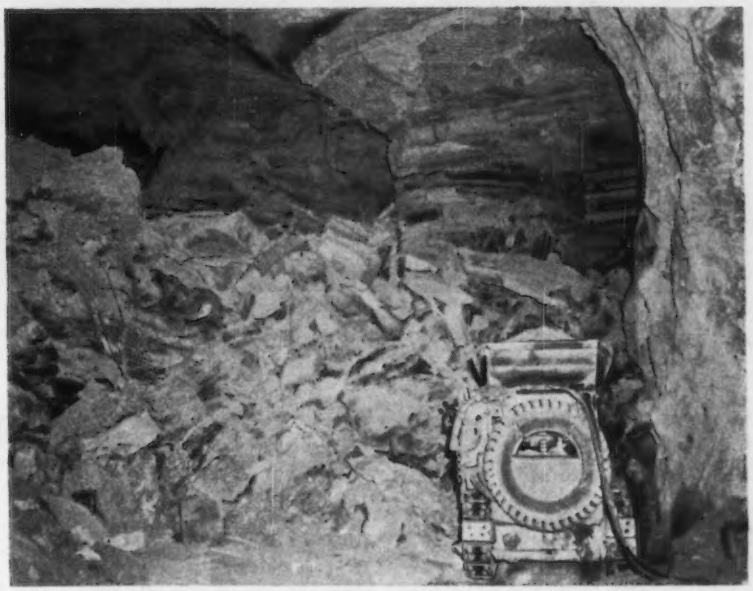
Planned operating distance from the remote station is 50 ft, with a maximum of 75 ft. Visibility is the limiting factor of the operation distance.

Included in the future improvements will be to have both power leads and control leads in one cable, for ease of cable handling; secondly, a reduction in weight and size of the remote station for greater maneuverability; and third, an original design for maximum strength and stability.

The remote controlled Eimco 630 has proved itself by recovering otherwise lost ore and making possible bulk blasting (800 tons or more) with the opportunity to recover safely the greater portion of the ore.



AT REMOTE CONTROL STATION, the remote control panel, main power safety switch, lighting transformer and two floodlights are contained on a platform.



SAFE LOADING without the cost of roof support in areas such as this make the remote operation a valuable mining tool. Control station is out of picture at right.

SKIN DIVING, a popular pastime in the warm waters off southern California's coast, is now a favorite hobby with weekend gold prospectors in northern streams. Cold water makes most divers wear suits like these. Scene is Yuba River in Sierras.

Skin Diving for Gold Becomes Popular

JOHN B. HUTTL

FROGMEN WHO LOOK FOR GOLD have populated the streams of central and northern California recently.

The skin diver with his aqua-lung, his fins and his face mask, and the bearded prospector with his pick and his pan—both these images come to mind readily, but they contrast sharply. Hobbyists in California have been combining the two roles into one.

These hobbyists, and the very few serious prospectors among them, interest the mining man because of the equipment that they have developed for their craft. This equipment the mining man may be able to apply in the serious business of exploring for mineral deposits in stream beds, lake bottoms, or elsewhere under water.

While this growth of skin-diving prospecting means an interesting new hobby for many people, it does not mean a new gold rush, nor any real boost to California's gold-mining industry. The State Division of Mines estimates that yearly gold production from skin diving is only a few thousand dollars' worth, though a few strikes have yielded several hundred dollars' worth apiece.

Based on an article by William B. Clark published in the June 1950 issue of MINERAL INFORMATION SERVICE, Division of Mines, State of California, Ferry Bldg. San Francisco.

Equipment

The equipment that divers use varies considerably. Experienced people use compressors, floating suction dredges, and underwater gold-recovery units; while beginners' equipment usually comprises only a snorkel and a miner's pan. The equipment may cost as little as $50, or it may cost several thousand dollars.

Because of the rough terrain along many California streams, gear should be durable and light-weight enough for two men to carry it. Experienced divers recommend that the beginner have the following minimum equipment: snorkel; face mask; weighted belt; fins; gold pan; and crevicing tool. Though a diving suit is not absolutely necessary, it is hard to do much work without one, since most California streams are cold.

"Dry" and "wet" suits are available. The first, which prevent any contact of the body with water, since all points are sealed, are needed only in very cold water. The second, which are most popular, are close-fitting, but allow a little water to penetrate; the body warms this water, which then serves as an insulating layer between body and suit. Divers favor gloves with separate thumbs and forefingers.

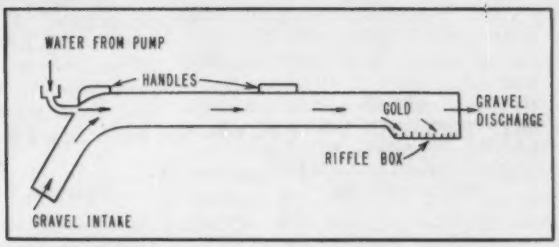
When the diver is covering a large area and needs to move about a lot, he wears fins. When he is standing, or working in a small area, he usually wears canvas shoes. Different individuals need different amounts of weight to keep them on the bottom; but all weighted belts must have quick releases, so they can be discarded in an emergency.

The more experienced, serious divers use self-contained underwater breathing apparatus, or SCUBA. The French developed this device in the Mediterranean, and U.S. Navy frogmen perfected it during World War II.

The device's parts are a mouth-

JET DREDGE, or "sucker," pictured here, is popular gold recovery device. Unit is light enough for two men to carry.

UNDERWATER VIEW shows two divers handling dredge on bottom.



SIMPLE DESIGN of jet dredge is shown here. Most units are 6-8 ft long, weigh about 20 lbs. Gold settles in riffle box.

Hobby in California

piece, an air regulator and an air supply in the form of a high-pressure cylinder carried on the diver's back. When he wants a more permanent supply of air, he connects this through a hose with a low-pressure air compressor on the surface. The compressor and air lines connected to the diver are collectively known as a "hookah." Most underwater mining operations use this assembly.

The hookah supplies air to two divers, usually at a rate of about 4 cfm for both. The compressor is a diaphragm-type unit. A self-lubricating one-cylinder gasoline motor powers it; this portable motor is of 1½-2 hp capacity, and burns regular gasoline, about one gal per hr, per hp. A piston-type compressor, like those used for pneumatic tools, should never be used here, because of the danger of poisoning from oil fumes.

The diaphragm-type compressor discharges to a 1- to 1½-cu-ft floating receiver or reserve tank, connected to the diver's air line. This auxiliary unit, which allows the air to cool and acts as a receiver for the air supply, supplies the diver with enough air to surface in the event of compressor failure. Rubber air-hose size ranges from ¼ to ⅜ in. The compressor either is on shore, or is mounted on a float, which follows the divers around as they work under water.

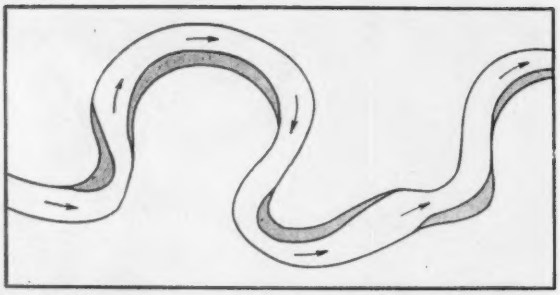
One of the most popular and successful items of equipment is an underwater gold-saving device known as a jet dredge or "sucker." The sketch of the dredge on this page shows its basic construction. It is a pipe-like device, curved at one end, usually made of galvanized sheet metal, but occasionally of plastic or spun glass. The curved end, which is the intake or nozzle end, is made of stainless steel or some other abrasion-resistant material. Most dredge models are six to eight ft long, and weigh about 20 lb.

At the dredge's upper end the head is connected, with a valve, to a hose coming down from a motor-driven water pump at the surface. This feeds water, under pressure, to the head. The injected water creates a vacuum at the mouth, and forces the sucked-up material through the pipe toward the discharge end. The lighter material is ejected from the discharge end, and the heavier material drops into a small riffle box near that end. Riffle boxes are from 6 to 12 in. long, and the riffles proper are one to two in. deep.

The water-pump motor, which is gasoline-driven, ranges from 6 to 10 hp. Water-hose size, which depends on the size of the sucker, varies from 1½ to 2 in. dia., and water-hose construction is usually of flexible heavy rubber. Some skin-diving operations are conducted from small floating dredges equipped with suction pumps and sluices.

A large syringe known as a gold sniffer is a very useful device for prospecting, especially for those who do not have dredge equipment. This

SHADED AREAS, showing west slope of Sierras, right, and Klamath Mountains, top, are favorable regions for California gold prospecting.



IN PLAN VIEW of stream course, shaded areas show where least velocity, most likelihood of gold deposition, are.

PICK-UP MAN on dredge team dislodges nuggets from bottom with crevicing tool.

unit can be made from a grease gun, the best type of which is one that unscrews on the front or nozzle end. Some are made from transparent plastic.

Crevicing tools include large spoons, knives, screw drivers, crowbars, and special types now on the market. Some other useful equipment: small bags attached to the diver's belt for nuggets; prospector's pick; hand magnifying glass for inspecting small gold particles; tweezers; gold scales; and bottles or vials for storing gold.

A great many types of small-sized gold-concentrating and gold-saving devices have been used in the past; estimates of over 7,000 have been made, particularly for the early 1930s, when many persons were engaged in small-scale placer mining.

Where to Look

The western slope of the Sierra Nevada, followed by the Klamath Mountain region in northwestern California, is the most favorable area for skin-diving for gold.

But, though this is an interesting and exciting hobby, it is a very poor way to try to make a living, because prospectors have mined most of these areas extensively in the past. Also, a discoverer may often have to pay royalties or rental payments to claim holders or property owners, as the land open for mineral exploration in California is getting smaller each year. A skin-diver or prospector who discovers a promising-looking area will often find that someone else has established ownership long before.

How It Is Done

The hobbyist-prospector must follow a logical procedure, if he wants to return at the end of the day with some tangible rewards from his efforts. Like any other prospector, he first must know where to look. That is, he must be able to recognize the favorable places for the occurrence of gold. A knowledge of how and why gold is deposited will help him, as will a knowledge of the gold-bearing regions of the state.

As a first step, he must carefully examine the stream and the adjacent terrain. The topography, the nature of the bedrock, including joint and crevice systems, the stream currents and bends in the streams, and any visible underwater features like crevices, large boulders, or any other barriers—these natural features he should note.

His eye may spot features favorable to gold deposition. This deposition is a result of the interaction between flowing water and its bed—an interaction which develops the important feature of natural traps. The action of flowing water is very complex; channel shape, volume rate of flow, and slope of channel all influence it.

Wherever the natural features or a change in the volume of water flowing have caused a sudden drop in stream velocity, conditions are favorable for gold prospecting. A drop in velocity lowers the carrying power of the stream, and it begins to deposit its load. The heaviest particles, including gold, will be dropped first. Therefore, concentrations of gold can be expect-

ed at wide points in the stream, near quiet pools below rapids, or along bends in the channel. In a straight channel, the current is swifter near the middle than near the sides, and swifter above mid-depth than below. At bends, transportation and deposition of gold become complicated; velocities within the stream change, so that the greatest velocity is near the outer, or concave, bank.

When the prospector thinks he has a promising area, he starts his search above the water level. He examines the stream bank for gold between the water line and the high water mark. He should remove material in narrow cracks and crevices with the crevicing tool, and pan it. Likewise, he should examine material from the downstream side of half-buried obstructions, and also fine roots, moss or other plant matter near the water, which commonly trap fine particles of gold. If gold or "colors" appear in the pan, the stream section is probably a good place to prospect further.

Some Likely Places

Having explored the stream bank, the prospector next looks beneath the water. He is wise to make preliminary trips with the snorkel, to determine the configuration of the bottom, the location of natural gold traps, and the nature of currents. If the stream proves unfavorable, his preliminary trips have saved him the considerable trouble of hauling mining equipment to the site and setting it up.

Deep narrow crevices and cracks, especially those that occur in steeply dipping rocks that strike or trend perpendicular to the stream flow, are particularly favorable for the occurrence of gold. A series of parallel, deep, narrow cracks is especially good, as it forms a natural riffle. Such traps are most likely to be found in gneiss and heavily jointed granitic and volcanic rocks. In some instances, long, trough-like crevices parallel to the stream flow act as natural sluice boxes. Natural irregularities at the bottom act as riffles or pockets to catch the gold.

Sometimes deep potholes are good gold traps. Potholes, which have been scoured out in the bedrock by gravels being spun around by eddying currents, occur chiefly below falls and rapids, and are most abundant in crystalline limestone and granitic rocks. However, the scouring action may also tend to grind up and dissipate the gold.

The downstream sides of large boulders or any type of obstruction may be favorable sites, since the eddying motion on the downstream side promotes the deposition of gold.

Gold, occurring as flat or rounded grains and flakes ranging from microscopic size to nuggets several inches across, is concentrated nearly always near the bottom of natural traps, the coarser gold usually being the deepest. Some gold found today is nearly white in color, indicating that prospectors have worked the stream before and have recovered the gold by amalgamation. Native mercury is occasionally found in those areas.

The gold is always associated with black sands composed chiefly of magnetite and, in smaller amounts, ilmenite, zircon and garnet. Small amounts of pyrite are also present; and, in very small amounts, greyish-white grains and nuggets of platinum may occur. The gold-bearing blacksands, at or near the bottom of the natural traps, are usually covered by accumulated sands, gravels, cobbles, boulders and wood fragments; this overburden sometimes contains values. Sources of the gold are veins, mineralized zones and older placer deposits. The finding of gold is partly luck, partly intelligent prospecting and painstaking observation. There is no magic formula for determining its presence.

When prospecting a crevice underwater, the diver can partially remove the loose overburden by "fanning" it with cupped hands, and can remove the heavier gold-bearing black sands at the bottom with the crevicing tool. The gold sniffer is especially valuable here.

Operating the Dredge

After selecting the area to be mined, the prospectors carry the equipment down to the stream and set it up. A two-man team operates the dredge. The dredge man stands and holds the dredge while it sucks up material; and the pick-up man lies nearly flat on his stomach and guides the dredge intake. The dredge man needs 40-50 lb of weight on his belt, in order to stand upright; and he also carries weights on his feet. The pick-up man carries about 30 lb of weights. He removes rocks too large for the intake, uses the tools to help clean out crevices, and moves rocks downstream and away from the mining operation, usually in a pail or large can.

When mining an area, the work should progress upstream, so that the divers will not be working in their own discarded tailings.

Jet dredges are particularly good for removing overburden, while at the same time recovering any contained values. A 6-in. dredge can handle from 12 to 16 cu yd per hr.

If considerable overburden must be removed in order to mine the bedrock, great care must be exercised to see that the walls of the excavation are not too steep, because of the danger of caving. The dredge man should act as a lookout when working in these excavations.

The jet dredge should be held nearly horizontal when mining, so that the gold will stay in the riffles. When these are full, the dredge is up-ended and turned over, and the riffle box is emptied into a special container for concentrates. This can be done either under water or on shore. At the end of the day the jet dredge concentrates are cleaned up with a miner's pan.

Safety Precautions

Divers for gold should observe the following safety precautions. (1) No person should ever dive alone. (2) Any person should have enough diving experience so that he can handle himself in the various situations and hazards encountered in mountain streams. (3) A diver should thoroughly understand the use and limitations of his equipment. Divers may encounter such hazards as swift and treacherous currents, snags, floating debris, shifting rocks and chilling water temperatures. Many places where skin divers hunt for gold are in isolated areas, far away from help.

Usually there are no decompression problems, because diving depths are seldom over 30 ft; there is no time limit for diving at these shallow depths. However, dives of any duration below 30 ft require careful planning and time allowances for decompression. For example, after two-hr work at 70 ft, one must allow 13 min at 20 ft, and 16 min at 10 ft, for decompression. A person lacking experience should attend one of the many diving schools in California.

Divers should carry a first aid kit on any trip, and should properly and promptly treat any cuts and bruises.

Because skin diving for gold involves great exertion and chilling water temperatures, the diver should be in reasonably good health. Those who suffer from chronic bronchitis, asthma, cardiac conditions or ear trouble, or who have a perforated ear drum, should not dive; nor should people with colds or sinus trouble, until they have recovered their health. A diver should never use ear plugs when diving with SCUBA. He should stick to a high-protein diet, and avoid heavy, gas-forming food and alcoholic beverages.

Skin-diving has grown along with a general interest in gold prospecting, which has brought many vacationers, tourists and weekend hobbyists to the banks of California's streams with pan, rocker, sluice, etc., to try to take home with them a remunerative souvenir.

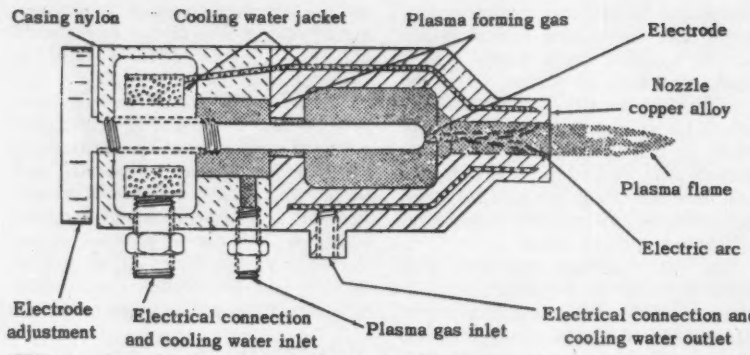


FIG. 1. Gas sheath stabilized plasma jet. In plasma arc, such as this, current density is too great for radiation and conduction alone to carry the heat away.

Ultra-Hot 'Plasmas' May Yield New Technologies

PAUL M. TYLER

WE ORDINARILY RECOGNIZE three states of matter—solid, liquid, and gas. A fourth state has been identified "plasma," or ionized gas, existing at very high temperatures.

At these temperatures—up to 50,000°C, by far the hottest controlled temperature that man has ever produced—reactions totally unfamiliar to us now may take place. Perhaps, some day, this may simplify extractive metallurgy as the wheel simplified transportation. Consider, for instance, a technique of extraction where we could vaporize any compound into its elements, and then condense the elements separately, one by one. Such an extractive process could separate the elements as easily as a change machine separates coins.

A tremendous lot of progress must lie ahead of us, before such an idea becomes a fact. But plasma technology, as it has been developed so far, points in that direction.

With this in mind, this article tells some of the progress that has already been made, and points to some ways in which the extractive metallurgist may hope to put plasma technology to use.

General Background

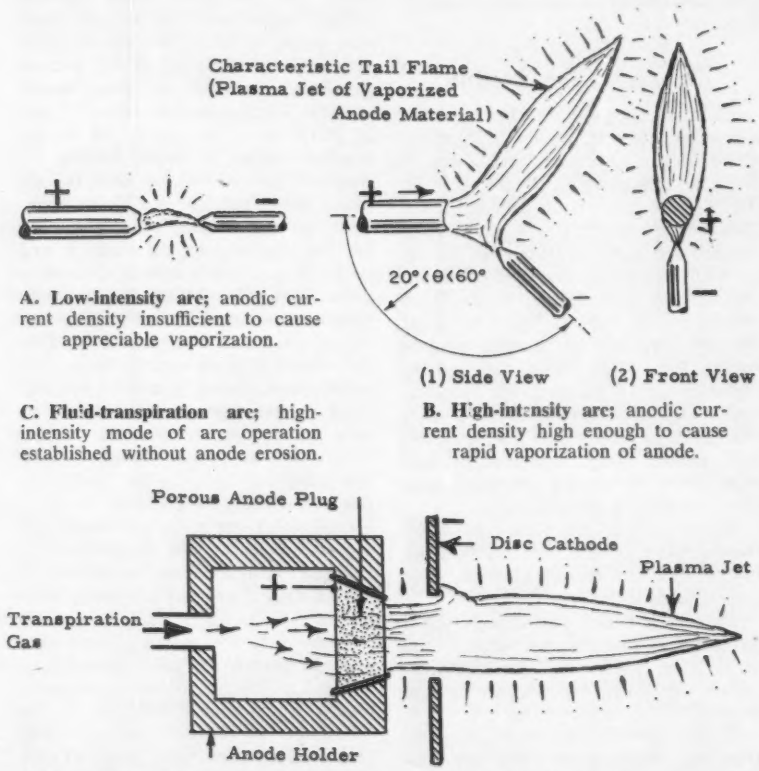
The hot gas, or plasma, from a plasma arc device, can be kept indefinitely at controlled temperatures ranging from below 4,000 up to 50,000° C. In contrast, till now we have been limited to temperatures of about one-tenth this level.

Specifically, the combustion of several exotic fuels may give sustained temperatures of over 4,000°C, though ordinary chemical flames fall far below this. In large electric furnaces, ordinary open-arc flames do not range much over 5,000°C, although temperatures above 20,000°C have been measured in the innermost cone near the cathode tip. In vacuum arc melting furnaces, and furnaces employing arcs in various inert atmospheres, maximum working temperature is probably limited to about 3,000°C, even though these have been greatly improved in conceptual design and operating efficiency.

But an important difference in the plasma flame is that its intense temperature can be confined in a very small space. Very likely, no refractory vessel could contain a bath of molten material at plasma temperatures. But the plasma flame is well suited to treating a continuously passing stream of material, rather than a large molten bath; and because it can be kept away from the walls, it does not demand super-refractories.

About $50-million a year is spent now on plasma research, largely by the federal government for military purposes, though private company laboratories are active too. I do not know of any commercial use of plasma phenomena in extractive metallurgy yet.

What distinguishes a plasma jet from an ordinary open arc discharge is that in the plasma jet the current density dissipated on the surface of an



A. Low-intensity arc; anodic current density insufficient to cause appreciable vaporization.

B. High-intensity arc; anodic current density high enough to cause rapid vaporization of anode.

C. Fluid-transpiration arc; high-intensity mode of arc operation established without anode erosion.

FIG. 2. COMPARE two types of high-intensity arc (*B,C*) with ordinary low-intensity arc (*A*). Former yield plasma discharge; latter is type employed in carbon-arc lamp.

Mr. Tyler is consulting metallurgical engineer, Washington, D.C. He served as staff consultant to the committee of the Materials Advisory Board which investigated applications of plasma phenomena.

arc electrode is greater than that which radiation and conduction alone can remove. One way to obtain such an increase in current density is to confine all or part of the arc column in a chamber or nozzle; a flow of relatively cool fluid, introduced under pressure, causes the arc column to be substantially restricted.

Fig. 1 shows a so-called "gas-sheath stabilized plasma jet" using a tungsten electrode. Fig. 2 shows two forms of the "high-intensity arc," the other method of developing high current density; also shown is a sketch of an ordinary low-intensity open arc.

The practical difference between the two principal types of plasma arc devices is the composition of the arc discharge. In the type in Fig. 1, and in various other devices where confining the arc column produces constriction, use of non-consumable electrodes causes the plasma to be derived from the gas or liquid injected into the arc chamber. But in the high-intensity arc, material vaporized from a consumable electrode feeds the arc; or alternatively, fluid transpired through a porous anode feeds it.

Temperatures Unlimited

Plasma techniques eliminate the temperature barrier that has often plagued pyrometallurgy. It has been customary to heat a charge to a temperature where desired reactions would take place, and where, preferably, the reaction products could be separated while molten. With many refractory ores, available heat sources could not produce high enough temperatures. Then the metallurgist has had to adopt a whole new process, or seek a lower-temperature reaction that would accomplish the desired result.

At plasma temperatures, all chemical bonds break instantly. Plasma chemistry differs from ordinary chemistry not only in that no solids are present, but also because ions and electrons are common species, and because the particles have greater kinetic energy. Reactions may happen above 5,000°C that are quite different from those observed at lower temperatures, in fact, that resemble those occurring in the inner parts of stars.

Liberation of a desired element from any mineral or intermediate product no longer presents a technological problem. The only problem is to inhibit back-reactions or to guide the formation of desirable atomic combinations that can survive at ordinary temperatures.

By keeping the flame away from refractory walls, plasma technology gets around the need for super-refractories. It also keeps down contamination, which occurs at the contact of a bath with furnace walls. Its high capacity in a small reaction zone makes it favorable for a high-speed flow process, rather than for prolonged treatment of a large bath.

Flame Chemistry

The plasma flame is a complicated physical and chemical system—a new environment that introduces parameters that we still do not clearly understand. In ordinary chemistry, simple substances usually become more reactive at higher temperatures. However, there comes a temperature where this trend reverses, and interatomic bonds are severed. When atoms are in highly excited electronic states, some of their outer electrons are in high-energy orbitals; this changes the familiar physical properties of the atom and its chemical behavior. One or more atoms in excited states can be made to combine with other excited atoms, and interactions between ions and molecules may stabilize unusual species.

Interestingly, too, since hot plasmas are electrically conductive, they can be confined in a magnetic "bottle." Thus they can be largely protected from contact with the walls of a containing vessel, and subjected not only to ultra-high temperatures but also to exceedingly high pressures.

These phenomena have led to growing interest in plasma technology as a tool for chemical synthesis, including the building up of macromolecules. They may also be significant in extractive metallurgy.

We can calculate thermodynamically that electric current breaks chemical bonds more efficiently by simple thermal action than by electrolysis, in either liquid or fused-salt baths. Look, for instance, at the highly developed aluminum industry.

Only about one quarter of the energy consumed is needed to free aluminum metal from its oxide. In the pot room itself, most of the power that is used is dissipated in maintaining the temperature of the bath, and in side reactions and unavoidable radiation and electrical losses. The Bayer process, which produces the alumina feed for the Hall electrolytic cell, requires a good deal of additional energy in some form.

Theoretically, aluminum could be liberated, in a single process step using relatively little energy, from crude bauxite, clay, or any complex silicate.

Another important feature of plasma technology is its enormous concentration of energy in a small space. Anode diameter for a plasma jet may range from ½ in. for a small 40-kw unit to 3 in. for a 3,000-kw unit; while in a Hall cell, the cathode normally absorbs not over 5 kw per sq ft. Thus an area the size of a dime handles eight times as much power as a surface roughly the size of this page.

High-Intensity Arc Process Developments

Most of the pioneering work to date aimed at developing practical applications of plasma phenomena in extractive metallurgy, has been done by Dr. Charles Sheer and associates of Vitro Corp. of America, West Orange, N.J., using high-intensity arcs. The consumable-anode arc processing technique, or "Hierarc" process, for treating refractory raw materials, was invented by Sheer and Korman. This type of arc, which Beck invented in Germany in 1910, has been widely used as a light source for high-powered searchlights, motion-picture projectors, etc.

For lighting purposes, the electrodes consist mainly of carbon, with significant additions of high-emissivity rare earth metal compounds, which enhance the brilliance of the flame. In the Sheer-Korman process, on the other hand, ore is mixed with only enough carbon to provide electrical conductivity.

In the original Sheer-Korman process, it was necessary to manufacture an electrode from the ore-carbon mixture. But alternatively, the unconsolidated mixture may be fed more or less continuously into a graphite crucible, so as to function as the consumable anode. A third modification of the high-intensity arc, which has been already noted and is shown in Fig. 2, has a non-consumable porous anode through which liquids or gases may be passed; but I have no knowledge of its actual use in extractive metallurgy research. All three types of high-intensity arcs, however, differ essentially from other types of arcs in that the input energy is transferred directly to the anode face, instead of emerging from the conduction column.

According to Dr. Sheer (private communication), the following four types of treatment using high-intensity arcs have been shown to be feasible: (a) thermal decomposition; (b) vapor phase halogenation; (c) vapor phase carbothermic reduction; (d) liquid phase carbothermic reduction.

Thermal Decomposition

In the Sheer-Korman process, the plasma flame, which streams rapidly away from the consumable anode, consists predominantly of elemental vapors. They include, of course, 15-20% of carbon vapor. If back re-

actions could be prevented, it would be possible to precipitate the elemental constituents separately, by fractional condensation.

Some progress has been made toward this ultimate objective, which would prove a revolutionary advance in extractive metallurgy. However, uitable control of the environment and the circumstances of condensation involve problems that may take years to work out.

If the flame is allowed to condense naturally in air, the product will consist usually of a mixture of the simpler oxides of the metallic constituents; and CO will pass off. When complex oxides or silicates—euxenite, beryl, kaolin, etc.—are present in the feed matter, the total residence time of the free atoms (and ions) in the flame is too short for polyatomic collisions. However, nobody has yet found a suitable technique for obtaining a quantitative yield of a metal product, free from oxide contamination or carbon contamination or both.

We may reasonably suppose that when we know more about chemical kinetics and develop better techniques, we can prevent the re-formation of metal oxide and carbon by ultra-fast cooling. There is little hope that this could be done in a large static mass such as exists in a conventional metallurgical furnace; but the flame configuration of the plasma flame reaction, on the other hand, would be relatively favorable. Synthetic chemists are successfully producing new compounds by "freezing" chemical equilibrium compositions that were formed at very high temperatures. De Laval nozzles already provide a cooling rate of 1-million deg C per sec, and even higher rates may be possible, discontinuously, with several ballistic pistons working on the principle of a Gatling gun.

Even though it may be too difficult to try to produce a metal product directly from the plasma flame, one might utilize the fact that the various simple oxides condense at different points along the flame, more or less according to their respective dew points. In most large pilot plant work to date, however, no one has attempted fractional precipitation of the oxides. The products have consisted of mixed oxides, which have to be treated by an extra process step to yield a metallic product. Rhodonite, for example, yields a mixture of finely divided MnO and SiO_2; and beryl yields BeO, Al_2O_3 and SiO_2.

Except that the reactions are in the vapor phase, the above approach is somewhat analogous to the melt-quench-leach method of attacking refractory ores, which the Bureau of Mines has studied extensively. However, the leaching step is made easier, because the vaporized product is very reactive. Experience has shown that the solubles go into solution very rapidly, and that the insolubles, despite their fine particle size, are easily filtered out. One can eliminate volatile impurities, such as phosphorus and sulphur, by locating the bag filter for removing the condensed solids at a point in the stream where the temperature is above the dew point of such undesired elements or their compounds.

Vapor Phase Halogenation

If the ore-bearing anodes such as those that the original Hierarc process uses are vaporized in a halogen (e.g. chlorine) atmosphere, and especially if chlorine gas is injected directly into the plasma flame, the metal oxides can be converted quantitatively to halides in the vapor state. The effluent will then consist essentially of a mixture of metallic chlorides and carbon monoxide. Since the boiling points of many of these chlorides are widely separated, this process makes it much easier to fractionate the arc effluent.

The chlorides of beryllium, iron, aluminum, columbium, silicon, etc., may be caught in suitably designed condensers below 500°C. The technical feasibility of this approach has been shown on such ores as beryl, kaolin and borax.

Fixed-bed chlorinations have been carried out industrially for many years (e.g. as feed material for the Kroll process or fused-salt electrolysis). But the plasma environment, although not essential for the reactions, is many orders of magnitude faster; and it avoids the corrosion problems involved in containing chlorine gas at high temperatures. A major advantage is that the high-speed flow process can treat a relatively high hourly tonnage, even though the quantity of material in the hot zone is always small. Quantitative yields have been obtained consistently from ores treated by this method (including complex silicates).

Vapor Phase Carbothermic Reduction

When the ratio of carbon to metal oxides in the consumable anode is stoichiometric, the plasma flame consists essentially of metal vapor and CO. The absence of detectable metallic oxide vapor in the flame has been confirmed spectroscopically in test runs for aluminum, magnesium and beryllium.

In principle, this process is nearly identical with the Hansgirg process for magnesium, which was operated in California during World War II. It was thought that back-reactions might be inhibited by having enough carbon present to combine with all the oxygen; and the relatively long and narrow high-velocity flame gives a more favorable configuration for quenching, and eliminates the explosion hazards that plagued the Hansgirg operations. However, by impinging the flame on a water-cooled plate, or by injecting cold hydrogen directly into the jet, only 40-70% of the metal content proved recoverable in pure form.

Though this result was superior to that obtained in the first reduction step of the Hansgirg process, it does not seem competitive with commercial processes now. Higher yields should be possible with more efficient shock-chilling methods; but here again we need to know more about quenching kinetics.

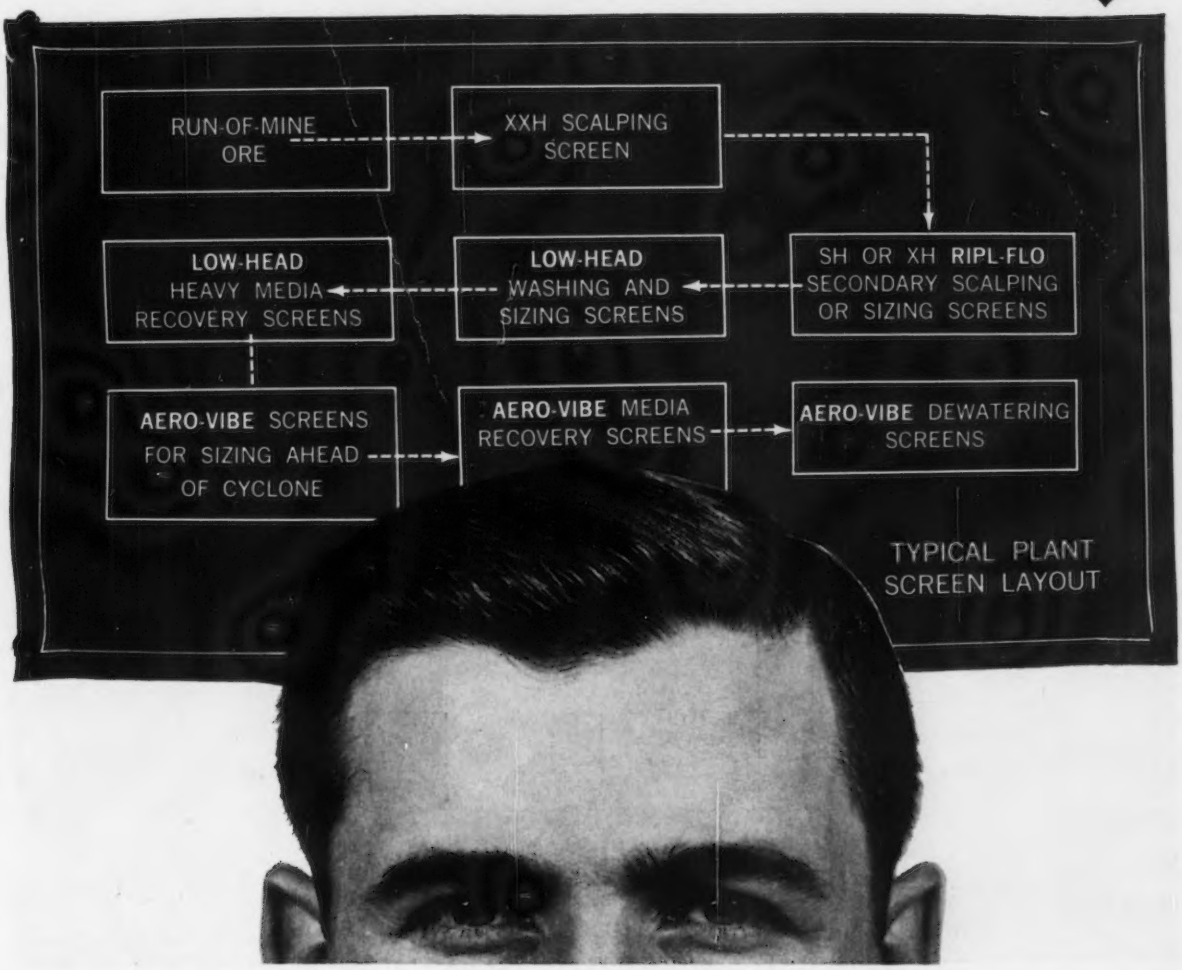
Liquid Phase Carbothermic Reduction

By manipulating the electric power input to the high-intensity arc equipment, one may avoid vaporization of the consumable anode. Various chemical reactions may be made to occur in the liquid state on the face of the anode.

This modified technique was first applied successfully to produce uranium carbide from the dioxide. Homogeneous electrodes were made, with stoichiometric proportions of C and UO_2, and the arc was established in a closed chamber at reduced pressure (1.5 mm). The surface temperature was kept at about 3500°C, to avoid vaporizing the refractory feed material. As the desired reactions happened, molten uranium carbide dripped steadily from the thin film of liquid on the surface of the anode, and the tail flame was composed of CO. The molten drops of carbide froze into spherical globules before reaching the bottom of the chamber, where they accumulated in the form of round shot, up to 5/16-in. in dia. The UC product was of almost theoretical density and analysis. No trace of free C, CO, UO_2, or U_2C_3 was found on X-ray diffraction analysis.

Limited experiments with various other reactions show that one can avoid back-reactions by keeping the temperature of the molten film just below the boiling point. By working under reduced pressure, one can eliminate volatile impurities; and there is a real possibility of developing a high-temperature fractional-distillation process. E.g., we might treat rhodonite, $MnSiO_3$, to produce a tail flame of Mn and CO, while molten silica and minor impurities would form droplets of molten slag.

ALLIS-CHALMERS


RUN-OF-MINE ORE
XXH SCALPING SCREEN
SH OR XH RIPL-FLO SECONDARY SCALPING OR SIZING SCREENS
LOW-HEAD WASHING AND SIZING SCREENS
LOW-HEAD HEAVY MEDIA RECOVERY SCREENS
AERO-VIBE SCREENS FOR SIZING AHEAD OF CYCLONE
AERO-VIBE MEDIA RECOVERY SCREENS
AERO-VIBE DEWATERING SCREENS
TYPICAL PLANT SCREEN LAYOUT

Analyze your plant flow, screen by screen:

How much are your screens costing you?

Short cuts in cost can only lead to trouble. There's no "safe" spot where you can economize on equipment. And this certainly applies to screens. They're an important part of the day-in, day-out dependability you have to have throughout your system.

All of your screening operations — scalping, sizing, washing, dewatering, media recovery — carry full responsibility for continuous, uninterrupted flow. To live up to this responsibility, your system needs screens that are engineered to do each specific job. A-C engineering has done just that — with a complete line of screens that assure you top performance under the most rugged conditions.

Ask your A-C representative about the specific features that make A-C screens a dependable part of your system. Or write **Allis-Chalmers,** *Industrial Equipment Division, Milwaukee 1, Wisconsin.* A-1370

Aero-Vibe, Low-Head and Ripl-Flo are Allis-Chalmers trademarks.

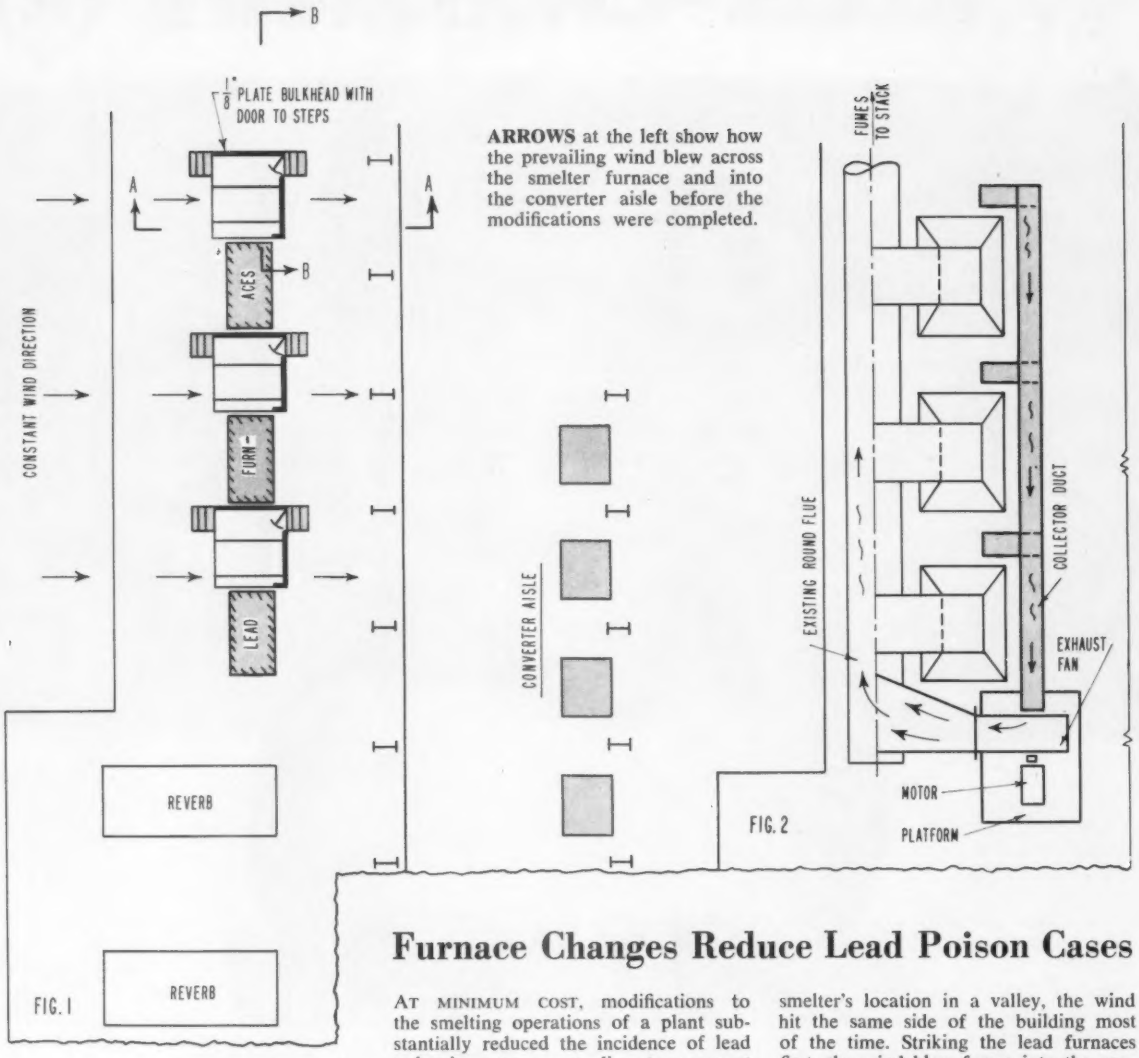
For media drain and dewatering in cyclone plants — AVS Aero-Vibe inclined screen.

Coarse to fine sizing (wet or dry), rinsing, washing, dewatering and media recovery — Low-Head horizontal screen saves headroom too.

For scalping and coarse sizing, wet or dry — XH Ripl-Flo rugged cost saving inclined screen.

For light scalping, coarse or fine sizing (wet or dry) rinsing or washing — SH Ripl-Flo inclined screen.

For tough primary scalping jobs and high tonnage — XXH ROM inclined screen.



ARROWS at the left show how the prevailing wind blew across the smelter furnace and into the converter aisle before the modifications were completed.

FIG. 1

FIG. 2

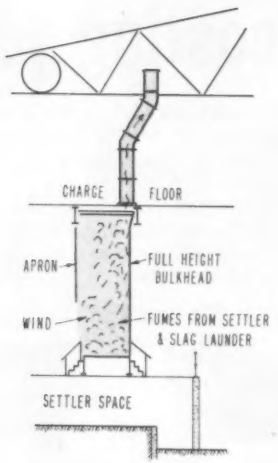
Furnace Changes Reduce Lead Poison Cases

AT MINIMUM COST, modifications to the smelting operations of a plant substantially reduced the incidence of lead poisoning cases, according to a report from C. H. Suckel, processing machinery dept. of Allis-Chalmers Mfg. Co.

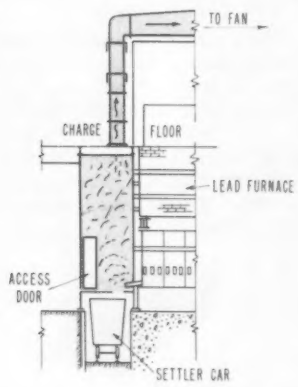
A study revealed that because of the smelter's location in a valley, the wind hit the same side of the building most of the time. Striking the lead furnaces first, the wind blew fumes into the converter aisle and through the building. This situation created conditions conducive to lead poisoning.

Heavy lines at the furnaces on Fig. 1 illustrate a solution that would not interfere with production. An apron was fastened to the charge-floor supporting steel (Sec. AA). This arrangement provided an opening above the platforms with enough headroom on the windward side to allow the prevailing wind to blow into this section. Sec. BB shows a head-on view of this set-up.

Heat from the lead settler and slag tap-off launder at the platform level caused the furnace fumes to rise, effectively creating a flue for each lead furnace. This natural draft situation was aided by a large-capacity suction fan that pulled the fumes into an existing round collector flue. Fig. 2 indicates how this fan was installed.

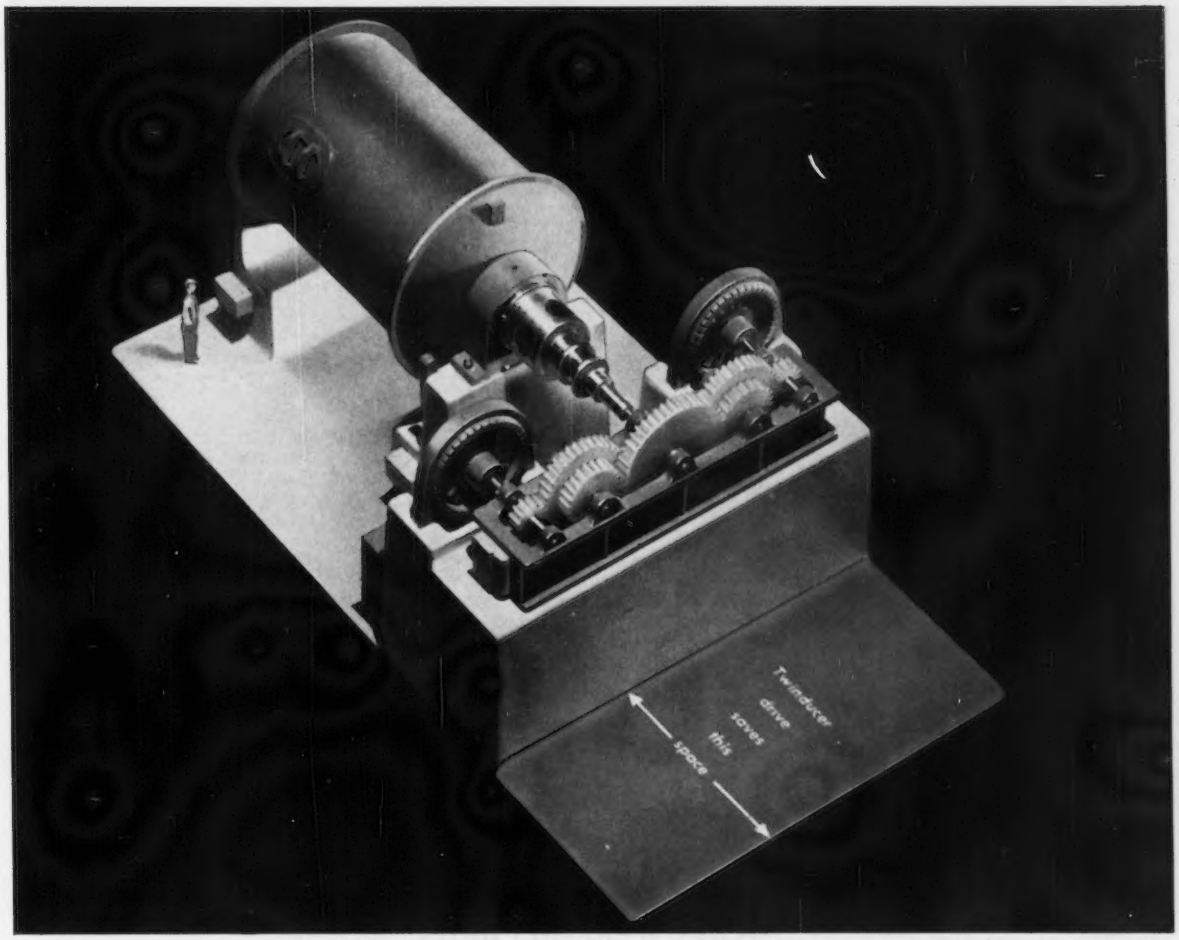


SECTION A-A



SECTION B-B

ALLIS-CHALMERS



A 2000-hp **Twinducer** drive mill conserves up to 16 feet of space compared to other trunnion drive designs.

Twinducer drive saves on space and wear...

divides mill loads electrically

Another Allis-Chalmers first — *Twinducer* drive mill — creates new space savings, new long-range operating and maintenance economies.

Dynamic electrical load distribution is accomplished through rotor shift of one of the two motors. Once the load is balanced and the rotor locked in place, there is no need for further adjustment. No need for a floating gear or pinion, either, since electrical, not mechanical, balancing is employed with *Twinducer* drive.

Gears and pinions experience less wear because they are fixed. Wear is further reduced because the gear train runs in a filtered oil bath, promoting longer gear life through both splash and flood lubrication.

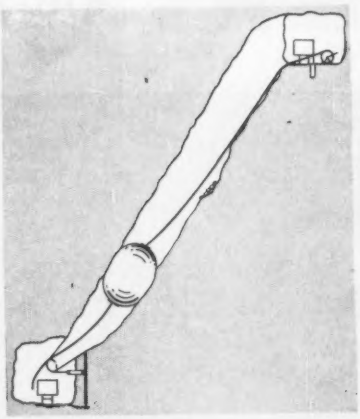
Twinducer drive efficiently harnesses the power of *two* synchronous motors located on the mill side of the drive. This unique, compact arrangement reduces drive dimensions drastically . . . as much as 16 feet on a 2000-hp drive.

Twinducer drive promotes better housekeeping, too. No lubricant leakage because the system is enclosed. No oversized foundations, no pits to collect waste materials and dirt.

Ask your A-C representative about the outstanding features of Twinducer drive mills. **Allis-Chalmers,** *Industrial Equipment Division, Milwaukee 1, Wis.*

Twinducer is an Allis-Chalmers trademark. A-1365

OPERATING IDEAS *(Continued)*



Rubber Balloon Plugs Raises, Stops Debris

A SWEDISH MINING COMPANY HAS FOUND A SOLUTION to avoid the risk of falling debris when consolidating vertical or steep raises.

An inflatable rubber "plug" that is gradually hauled up as the consolidation work progresses provides a resilient umbrella over the crew. This method was successfully utilized for the consolidation of raises up to 180 m.

The contraption, reported in the European Technical Digest of European Productivity Agency, looks like a rubber balloon with nylon-cord reinforcement. For added protection, the topside of the balloon can be covered with gunny sacks filled with wood shavings. A 25-m fall of a one-cubic-meter rock failed to damage the plug, according to the mining company.

Roller's Big Enemy Is Dirt, Test Shows

A DISTRIBUTOR SERVICE MANAGER for a fleet of large-size crawlers showed recently that dirt is the greatest track-roller enemy, and that improper lubrication can be worse for equipment than none at all.

The track-roller seals and bushings of the dozers and pushers of a Midwestern dirt-moving contractor were not showing good performance, despite the prompt attention to lubrication of a maintenance-minded master mechanic. Oilers appeared conscientious, at least to the point of following the lube charts and hitting all the fittings. The distributor could see nothing significant when he first looked into the situation.

A closer look pointed up the trouble. The oiler greased every roller, but he also shoved liberal amounts of sandy mud into the cavities. Both the job superintendent and the master mechanic were unimpressed with this finding, so the service manager took the opportunity to develop a clear demonstration.

One of the older dozers had gone through a set of rollers that had been built up several times, and the tractor was ready for a set of new shells. Taking one roller from the new set, the service manager lubricated it carefully in the shop. Then he welded shut the lube plug. The owner of the spread was told to lubricate the other rollers as usual, but the sealed roller was not to be touched.

The crawler went back to work, and the standard rollers were lubed every 500 hrs. Unaware of the experiment, the lube man greased the six other rollers in the frame in his usual haphazard manner.

Following 3,600 hrs of operation, roller shells were ready for a weld material buildup. During that period, the sealed roller operated perfectly, with no noticeable leakage or loosening of the shaft. The other rollers had experienced their usual seal problems, beginning at the 2,000-hr mark.

Still sealed, the test roller was shipped to the International Harvester Co.'s Construction Equipment Div. service dept. for a thorough examination. When opened it still contained a full supply of lubricant. The inner shell bore showed no taper, and only 0.001 in. wear. The bushings were tapered 0.005 in., and revealed 0.006 in. wear on the bottom surface. And there were no scratches, scores, or indications of excess heat, according to the IH report.

The roller could have been "new-conditioned" to new roller tolerances without the addition of one new part.

Emery Aggregate Cuts Heavy Wear on Floors

HEAVY WEAR ON CONCRETE FLOORING from grouser treads on tractors can be cut substantially by installing a low-water-ratio concrete made with a graded emery aggregate. After two years of testing, Caterpillar Tractor Co., Peoria, Ill., found that patches of emery aggregate flooring were still holding up well even under the punishment of a 60,973-lb diesel tractor.

Partial replacement of the eight-inch 6,000-lb concrete floors used to be necessary three or four times a year because of the cutting and pressure caused by the tractor shoes. The original areas of concrete broke up on the surface first, then as wear became progressively worse, the base slab itself began to crack.

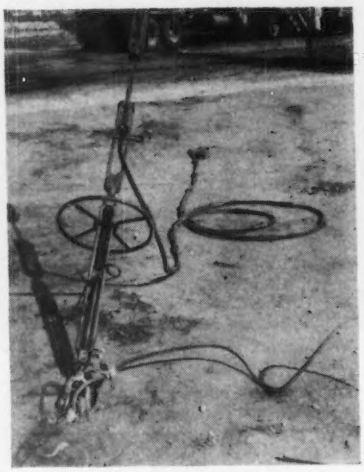
Originally, replacement was with a new concrete base, eight inches thick, and a protective wood block surface. Wood blocks prevented breakup of the base concrete, but also required renewal every few months.

With replacement cost mounting, plant engineers put down a test patch of emery aggregate concrete. On the basis of the two year test run, Caterpillar decided to use this flooring in more critical plant areas.

Detector Plate Spots Carbon Monoxide

A NEW DETECTOR PLATE MONITOR recently introduced in Denmark detects carbon monoxide in 0.01% concentration in 15 min. It consists of a small 5x5-cm plastic plate with a disk-like insert containing a special sensing substance of the same yellow tint as the plate. In the presence of carbon monoxide, the insert turns grey or black, depending on the degree of concentration of the gas.

If the carbon monoxide concentration is 0.02%, the plate will turn color in five min. Detection is immediate when this proportion reaches 0.05%. Self-regeneration occurs after exposure in non-contaminated air for 30 to 60 min., according to a report of the European Productivity Agency. And the plate can be used a number of times before losing its efficiency.

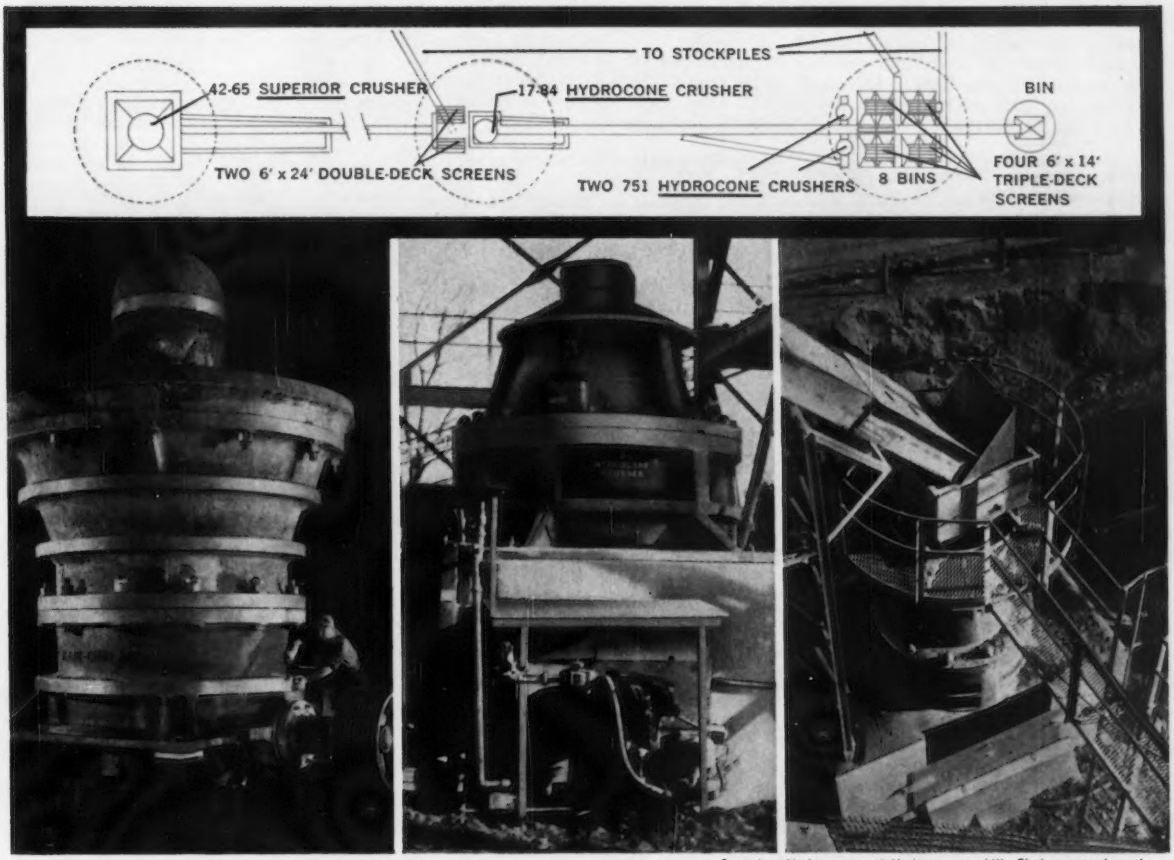


Wheel & Turnbuckle Set Drill-Rig Wires

A SIMPLE WAY to hook up drill-rig guy wires is to use an auger-type guy line anchor and a turnbuckle with wheel attached, according to Harry Hess of Houston, Tex.

After the rig is spotted over the drill site, match turnbuckles with the end of the anchor and slip the guy wires into one of the convenient knots babbitted onto the line every two feet. To bring the proper tightness to the guy wires spin the wheel. The ends of the threaded parts are drilled and a hairpin installed to keep the turnbuckles from turning.

ALLIS-CHALMERS



Superior, Hydrocone and Hydroset are Allis-Chalmers trademarks.

Rugged Hydroset control sets a fast pace for crushers:

900,000 tons in 4½ months!

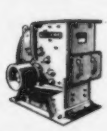
Crushing trap-rock is a tough assignment. A tight time schedule makes it even tougher for Chantilly Crushed Stone Company. They were awarded the contract for all of the crushed stone — base course and concrete specification stone — for the new $75,000,000 John Foster Dulles Airport just outside Washington, D. C.

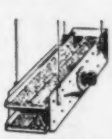
To meet production requirements, they had to have crushers that were rugged and dependable. Crushers that would provide rapid compensation for the wear that always accompanies the crushing of trap-rock. Crushers that would *not* require extensive downtime to unload in the event of power failure.

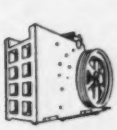
To get the job done, Chantilly built their plant around four Allis-Chalmers crushers: a 42-65 *Superior* gyratory for primary crushing, a 17-84 *Hydrocone* crusher for secondary crushing, and two 751 *Hydrocone* crushers for tertiary crushing. All four crushers were equipped with *Hydroset* control.

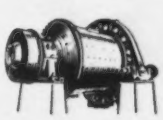
It was *Hydroset* control that made compensations for wear in minutes, not hours... made the quick changes in product size from base course to concrete specs.

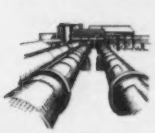
Ask your A-C representative about the rugged flexibility of A-C crushers equipped with Hydroset control. Or write **Allis-Chalmers,** *Industrial Equipment Division, Milwaukee 1, Wisconsin.* A-1336


Hammer Mill


Vibrating Screen


Jaw Crusher

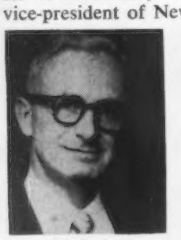

Grinding Mill


Kiln

PERSONALS

Emmett W. Waltman has retired after completing 44 yrs of continuous service with The Bunker Hill Co. Waltman, who was assistant manager of Plant Services div. when he retired, started as mine helper, in 1916, and resumed his service with the Bunker Hill engineering crew after returning from World War I duty in 1919.

H. I. Altshuler, mining engineer and vice-president of New York & Honduras Rosario Mining Co., has become an associate member of Behre Dolbear & Co., consultants to the mineral industries.



Altshuler

Parke A. Hodges, vice-president of Behre Dolbear, has gone to Australia on professional work.

Chas. H. Behre and **A. F. Banfield,** of the same firm, attended the International Geological Congress in Copenhagen in August. Dr. Banfield presented a paper on the mineral resources of Iran, where he spent several months in 1958.

John G. Stinrich has been promoted from pot-room superintendent to production superintendent at the Mead, Wash., plant of Kaiser Aluminum and Chemical Corp. He was succeeded by **Joseph Y. Naylor,** who had been carbon plant superintendent. New carbon plant superintendent is **David A. Craig,** who was formerly materials manager at the company's Chalmette, La., reduction plant.

Lennon J. McAdams, who had served at the Mead plant since 1946, when Kaiser began aluminum operations, most recently being production superintendent, was named production superintendent of the Chalmette plant.

Marion H. Hall, Hibbing, Minn., has been appointed chief iron ore grader for the Oliver Iron Mining Div., U.S. Steel Corp. He succeeds **Gordon H. Sharlach,** who has retired.

Thomas Stephenson, Virginia, Minn., has been appointed chief engineer for Jones & Laughlin's Minnesota Ore Div. **William Betzler** has been made asst. chief engineer in charge of operations, and **Roger Moen** asst. chief engineer of development.

F. M. La Duke, Virginia, asst chief accountant for the Minnesota Ore Div., has been transferred to the Pittsburgh office. **James A. Janzig,** Virginia, cost analyst, has been promoted to chief accountant.

Frank Ambrozich, Hibbing, has been advanced to chief electrician for M. A. Hanna Co.'s Mesabi Range mines to succeed **Frank Bohan,** who has retired.

Robert D. Hutchinson has been named Northwest district geologist for Bear Creek Mining Co., succeeding S. E. Jerome, who resigned in July. Hutchinson has served on the staffs of the Geological Survey of Canada and Union Carbide Ore Co., and has been district geologist for Kennco Explorations (Canada) Ltd. in central Canada.

Mike Petrovich of Rock Springs has been elected secretary of the Wyo. state board of mines, to succeed **Robert Love** of Green River, who was transferred by Food Machinery & Chemical Corp. to New York.

Bill Wiser of Sunrise was named to the board, succeeding **Clayton Miller,** also of Sunrise, who resigned.

Thomas L. Carey, who has been mining consultant in the Chicago office of Armour & Co. since Sept. 1959, has been named director of exploration and mining development for Armour Agricultural Chemical Co., Atlanta, Ga.

Shreve

Bryant

G. H. Bryant, formerly mill superintendent of Riverton, Wyo., facilities of Susquehanna-Western Inc., has been named manager of the company's metallurgical division. **Richard E. Shreve,** who was superintendent of the Gunnison Mining Co. uranium mill, Gunnison, Colo., succeeded Bryant as Riverton mill superintendent.

Hal D. Webb has been promoted from mill superintendent to mill manager at the Edgemont, S.D., plant of Mines Development Inc., a company associated with Susquehanna-Western.

Webb

McGann

Paul W. McGann, chief economist for the U.S. Bureau of Mines, has joined the Washington staff of Arthur D. Little Inc., industrial research and consulting firm of Cambridge, Mass.

Charles E. Erdman, research geologist with the USGS at Great Falls, Mont., was one of 28 official U.S. delegates to the International Geological Congress, Copenhagen, Aug. 15-25.

Walter C. Hahn Jr. joined the faculty of Montana School of Mines, Butte, in September as assistant professor of metallurgy. Dr. Hahn received his Ph.D. from Pennsylvania State University earlier this yr.

Charles E. Schwab was named president and chief executive officer of The Bunker Hill Co., effective Sept 15. He filled the position left vacant by the accidental death last November of John D. Bradley. Mr. Schwab had served as the company's general manager of Kellogg operations since Jan. 1, and been named a vice-president on April 1. He is well known to men in the lead-zinc industry for his 2½ yrs service as chairman of the Emergency Lead-Zinc Committee in Washington.

Schwab

Emmett G. Solomon, vice-president and a member of the board of directors of Bunker Hill, who had been serving as the company's interim chief executive officer, was named chairman of the board.

Waldo C. Portz, for 25 yrs general superintendent of Interlake Iron Corp.'s plant in Erie, Pa., has retired. Portz joined Interlake Iron in 1923, and after working up through various supervisory positions he was appointed Erie plant general superintendent in 1935.

Ralph R. Thomas, assistant general superintendent at Erie since 1943, has succeeded Mr. Portz as general superintendent.

Richard F. Brooks has been named as vice-president of Desert Minerals Inc. and its affiliate, American Mineral Co., both of Los Angeles. He recently resigned as director of mining and raw material development of Gladding, McBean & Co., with which he had been affiliated since 1948. Brooks is acting chairman of the Southern California chapter of the California Mine Operators Assn.

Brooks

John R. Hayes heads a list of six faculty members recently promoted by Colorado School of Mines, Golden. Dr. Hayes was promoted to full professor of geology. Other advancements were: Dr. **Frank S. Mathews,** to associate professor of physics; Dr. **Anton G. Pegis,** to associate professor of English; Dr. **Robert J. Weimer,** to associate professor of geology; **Hildreth Frost, Jr.,** to assistant professor of metallurgy; and **John M. George,** to assistant professor of English.

This Red Rubber is a better rubber for runners pumping abrasive pulps because it has...

Higher tensile strength

Higher tear resistance

High resilience and Greater abrasion resistance

This abrasive resistant stock is standard on all runners for DENVER SRL and SRL "Tru-Glandless" Pumps (sizes to 10" x 8"). Other polymers are available for applications involving high temperatures, oils or acids where abrasion is a secondary problem.

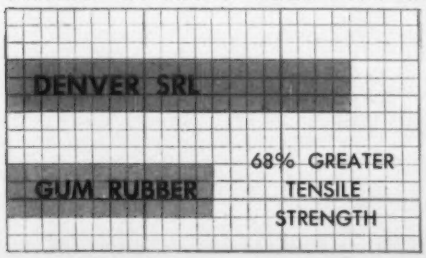
This permits handling coarser pulps at higher pumping speeds and heads... at lower costs!*

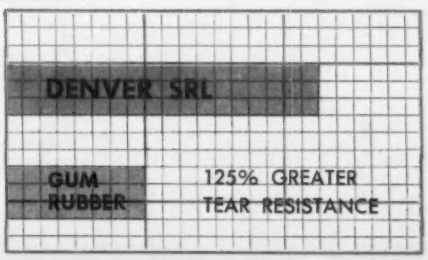
These DENVER SRL Pump runners are especially suited for pumping grinding mill discharge to cyclone classifiers where coarse particles (up to ¾") normally would be a problem.

Tough, live DENVER SRL Red Rubber outwears, outlasts, outperforms generally-used gum rubber and allows DENVER SRL Rubber Lined Pumps to be used where metal pumps have been considered necessary.

**We are interested in cutting your pumping costs—and we have the pumps to do it! Give us a chance at your toughest pumping job.*

THESE CHARTS TELL THE STORY....





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WHAT'S NEW IN PATENTS

OLIVER S. NORTH

U.S. PATENTS

Mining

Curtain structure for use in a mine to effect the desired circulation of air therethrough. A flexible, fire-resistant sheet is fastened to the floor and roof of the mine working. J. V. Burgess. U.S. 2,947,239.

Design for an improved mucking machine of the swingable, telescopic boom type, particularly suitable for sinking inclined mine shafts. R. T. MacAlpine and L. A. James, assigned to Shaft Machines Ltd. U.S. 2,949,201.

Metal and Mineral Processing

Improved cone and method for pelletizing moist iron oxide ore concentrates. A surface of the moist ore is continuously built up and scraped in narrow, separate areas to form the pellets. The scraper member moves progressively across the surface of the ore material. F. D. De Vaney, assigned to Erie Mining Co. U.S. 2,947,026.

Method for recovering metal values from a complex pegmatite-ore feed material and thereafter producing, from the residual alkali metal sulphate solution, commercial sodium sulphate and potassium sulphate. A. M. Thomsen. U.S. 2,949,342.

CANADIAN PATENTS

Mining

Method of and apparatus for the thermal piercing of holes in rock or ore, such as taconite ore. An intensely hot oxy-fuel flame is applied at a jet linear velocity of greater than 2,500 ft per sec, to cause spalling of the rock or ore, and the spalled material is blown from the hole. G. H. Smith and W. J. Mitchell, assigned to Union Carbide Canada Ltd. July 26, 1960. Canadian 602,348.

Metal and Mineral Processing

Two-stage froth flotation method for recovering from sylvinite ore high-grade coarse- and standard-size sylvite products. A limited amount of sylvite collector reagent is added to the pulp in the first stage, thereby floating only the coarse sylvite product. The first-stage underflow is then treated with additional collector to float the standard-size particles in the second flotation stage. E. A. Schoeld, J. D. Nabors and J. S. Reiter, assigned to Potash Co. of America. June 28, 1960. Canadian 600,695.

In a simple and direct process for separating columbium from tantalum, the ground ore is mixed with ammonium bifluoride and/or an alkali metal bifluoride, and the mixture heated to melt a bifluoride in the mixture and form complex fluorides of columbium and tantalum having different solubilities in water. The fluorides are then separated by extraction with water, whereby the complex columbium fluoride is dissolved. N. L. Campbell and R. C. Vickery, assigned to Horizons Inc. July 12, 1960. Canadian 601,640.

Process for making uniform, hard, separate pellets of iron-oxide ore or concentrates, such as magnetite produced from taconite. Pellets made by any of the well-known methods, such as briquetting, extrusion or balling, are formed into a gas-permeable bed and passed through at least three separate treating zones. After preheating, the pellets are tumbled through a rotary kiln in an oxidizing gas, at high temperature. A continuous network of bridged hematite is formed in the pellets. W. F. Stowasser, Jr., assigned to Allis-Chalmers Mfg. Co. July 19, 1960. Canadian 602,116.

To facilitate the fine grinding of mica, vermiculite, lepidolite, and other micaceous minerals, the material is heated at 1,000-1,600 deg. F., preferably about 1,400 deg. F., for 5-15 min. The material may then be ground in any type grinding mill, using either a dry or wet grinding procedure. R. Leblanc. July 26, 1960. Canadian 602,193.

Froth flotation process for concentrating pyrochlore, perovskite, niocalite, betafite, and other columbium-bearing minerals from ores thereof. In one method, the ground ore is conditioned with a depressant for the columbium-bearing minerals and then subjected to froth flotation to float off the gangue minerals; the underflow is conditioned with a cationic promoter and a selective activator for the columbium minerals, and subjected to froth flotation in an acid circuit. Alternatively, the columbium minerals and oxides and silicates are floated in a first step, the mica impurity is removed, and the columbium minerals are selectively floated in a second stage. R. J. A. Faucher and S. Dessureaux, assigned to Technical Managers Inc. Aug. 2, 1960. Canadian 602,917.

BRITISH PATENTS

Mining

Method for driving drifts, tunnels, shafts, etc., which are to be made at least roughly parallel to an existing working. Holes are drilled from the existing working through the rock to be left standing, and onward across the width of the working being driven; thus the blast holes for the new working are all substantially parallel with the face thereof, so that maximum efficiency is obtained from the explosives used. The holes are loaded with explosives only across the width of the blasting face. E. I. Janelid. June 22, 1960. British 838,192.

In a method for lining a mine shaft with concrete, the shaft lining is constructed in consecutive sections from the top downward. A sliding mold is suspended in the shaft from a frame anchored in the preceding section by radial expansion. Assigned to J. H. Laeven N.V. July 13, 1960. British 840,875.

Metal and Mineral Processing

Method of controlling an ore-sintering plant which sharply lessens requirements for materials-storage bunkers between ore-fuel mixing facilities and the sintering apparatus. A highly stable master voltage is set up to control the proportions of ore, fuel and water fed to the sintering band, in accordance with the rate of discharge. Other variables controlled are depth of bed, speeds of bands conveying raw materials to the sintering band, and performance of the cooling zone that follows the sintering machine. Assigned to Carl Schenck Maschinenfabrik G.m.b.H. June 15, 1960. British 837,740.

Double-impeller froth-flotation cell for obtaining improved aeration of ore pulps. A vortex established by the lower impeller circulates the pulp downwardly towards the bottom of the cell and thence outwardly and upwardly. Advantages include prevention of accumulations of solids in corners, increased capacity, lessened power consumption, and decrease in wear of parts. W. W. Potter. June 22, 1960. British 838,302.

Apparatus for the continuous agglomeration of fine ores by roasting and sintering, by the use of an electric current flowing through the mass of ore and producing temperatures of 800-1,200 deg. C. A three-layer sintering bed is formed on a troughed conveying band. A layer of fine ore is placed on the conveyor, and covered first by a layer of iron chips or other material of greater electrical conductivity than the ore, and then by another layer of fine ore. Assigned to Klockner-Huttenwerk Haspe A.G. June 22, 1960. British 838,870.

Device for charging an iron-ore blast furnace, whereby the feed material can be discharged either into the center or at the periphery of the furnance, as desired. P. Rheinlander, H. Schumacher and J. Biasutti, assigned to Huttenwerk Salzgitter A.G. July 20, 1960. British 841,670.

Copies of U.S. patents can be purchased at 25c each from the Commissioner of Patents, Washington 25, D.C.

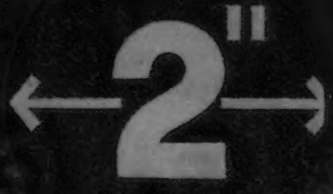
Copies of Canadian patents can be obtained by writing to Commissioner of Patents, Patent & Copyright Office, No. 8 Bldg., Carling Ave., Ottawa.

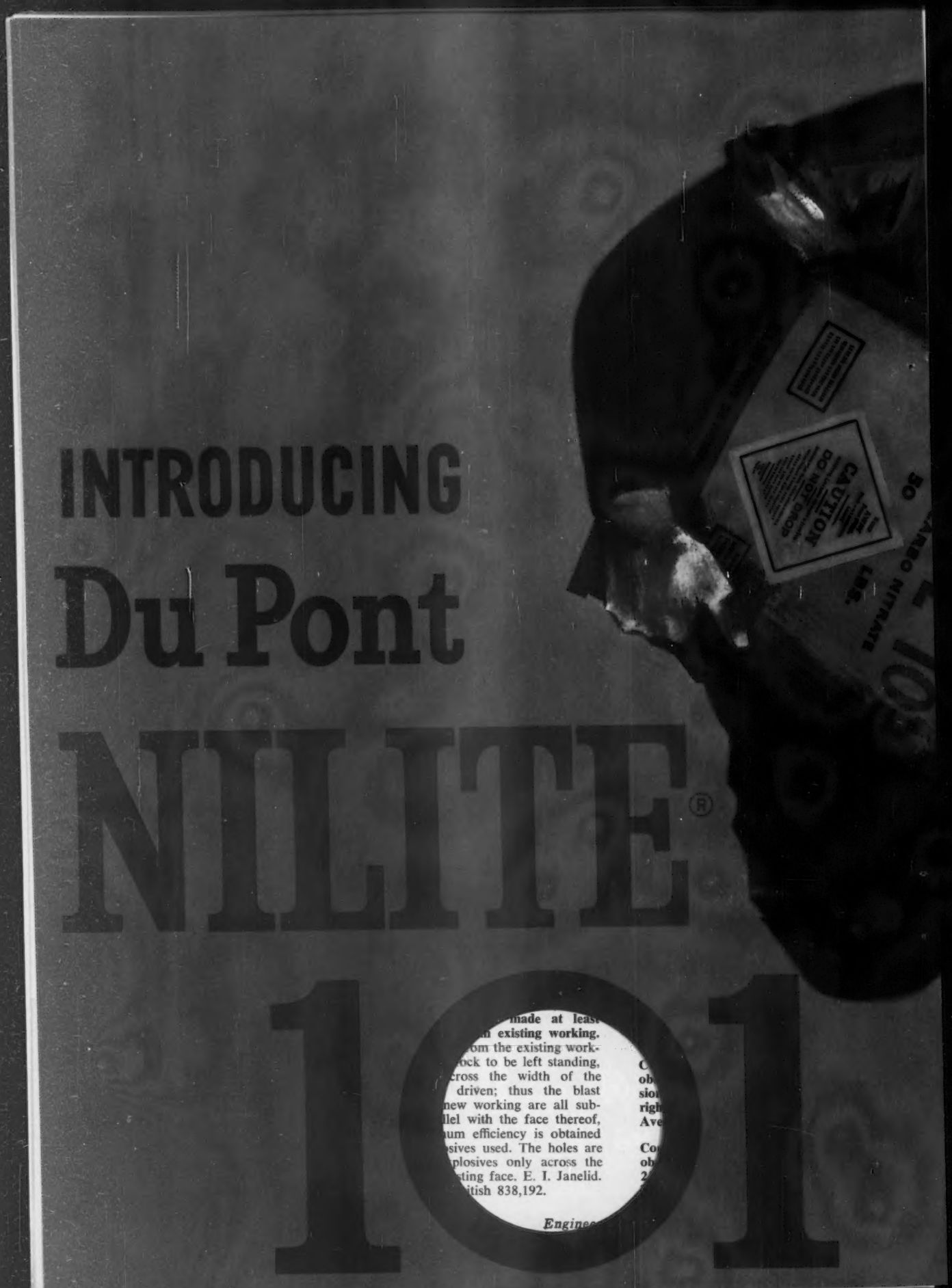
Copies of British patents can be obtained from the Patent Office, 25 Southampton Bldgs., London W.C. 2, England.

Mr. North is a patent consultant, Washington, D.C.

Explosive NEWS From DuPont

FOR
BETTER BLASTING
IN HOLES
AS SMALL AS
THIS!




INTRODUCING
Du Pont
NILITE®
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Engine
CAUTION
50
LBS.

NEW ECONOMY EXPLOSIVE

you don't have to mix

The minute you tear the corner off your first 50-lb. bag of "Nilite" 101, you'll know you've entered a new era in blasting.

Now at last here is a low-priced, free-running explosive that gives you DuPont quality performance, in shot after shot.

You don't mix "Nilite" 101 on the job. You don't mix it at all. Just rip open the bag and pour it into any hole —small, medium, large—from 2″ diameter up. No clogging, no bridging in the hole.

No clouds of dust, and no ingredient to cause headaches. Ask the men on the blasting crew how they'd like that.

But easy loading is just the first of many improvements you'll find in "Nilite" 101.

It has a rock-breaking wallop you've learned not to look for in "economy" explosives. In fact, you'll get performance equal to that of 60% extra dynamite.

What else?

We've counted 12 ways you'll save time, save money and move more rock per day.

They're on the next page...

Flows freely even in holes as small as...

1. **LOW COST** The low price of "Nilite" 101, plus the low labor costs (no mixing on the job, no caked and hard-to-pour bags), add up to real blasting economy.

2. **NO MIXING** No oil to buy or store. No costly or potentially hazardous mixing on the job. Just tear open a bag of "Nilite" 101, and pour it into the hole.

3. **NO LOST STRENGTH** Because there's no on-the-job mixing, you don't risk losing strength through ineffective blending which can decrease an explosive's potential strength by 30% or more.

4. **NO CAKING** The particles of "Nilite" 101 are designed to resist setting and caking, even in storage. It stays free-flowing longer than other bulk explosives not so designed.

5. **EASY LOADING** Pours freely into holes as small as 2″ in diameter. Fills the entire cross-section of the hole.

6. **NON DUSTING** Even when loading on windy days, there is no dust problem with "Nilite" 101.

You owe it to yourself to investigate AND PROFIT BY the advantages now possible only with the new

DU PONT "NILITE" 101

7. **NO HEADACHES** "Nilite" 101 will not cause headaches among your blasting crew.

8. **EASY PRIMING** "Nilite" 101 performs reliably when primed with small dynamite or high detonation pressure primers.

9. **EXCELLENT BREAKAGE** "Nilite" 101 consistently outperforms field mixed blasting agents in producing desired fragmentation.

10. **BETTER PROPAGATION** "Nilite" 101 is considerably more sensitive to propagation than prill/oil mixtures.

11. **GREATER SAFETY** "Nilite" 101 is a true nitro-carbo-nitrate (NCN) blasting agent as defined by the Interstate Commerce Commission, and as such is vastly safer to use than any type of dynamite.

12. **REPRODUCIBLE RESULTS** From shot to shot, you can get dependable results with "Nilite" 101—manufactured under the quality control standards that have established Du Pont explosives as performance leaders in all types of blasting.

UNTIL *YOU* tear open a bag of "Nilite" 101, you'll never know whether you are paying more than you should for each blast.

For a demonstration or a detailed description of Du Pont "Nilite" 101, call your Du Pont Explosives representative or distributor, or send the coupon.

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Please send me the fact-sheet on your new economy explosive, "Nilite" 101. ☐ I would also like to see a salesman.

NAME .....

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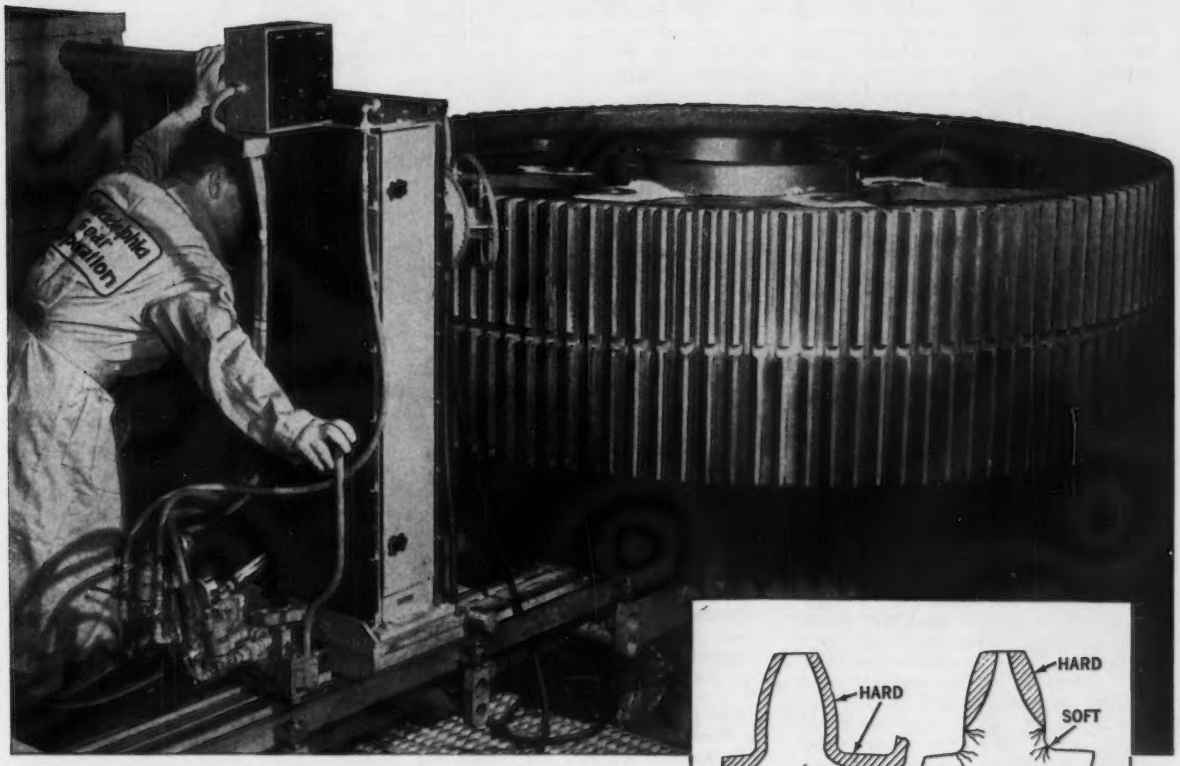
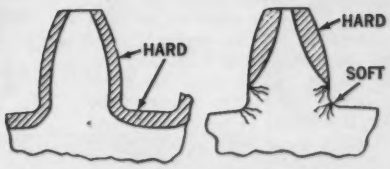
ADDRESS .....

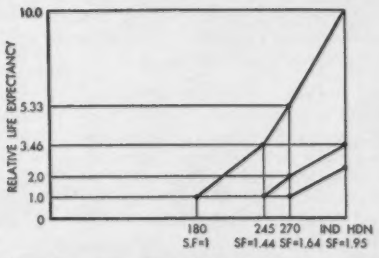
CITY ..... ZONE ..... STATE .....

New Philadelphia induction hardening increases life of large gear drives . . .





New Philadelphia full contour induction hardening (left) provides a continuous hardened area from one tooth flank around the root and up the other flank without interruption. There are no points of stress. Typical heat treated gear (right) shows inadequate hardening of root of tooth, a point of major stress.



This chart shows the relationship between load and gear life. Note that the improved service factor of a gear set may be used to substantially increase gear life, rather than to increase the load.

HERE'S WHY: Full tooth contour induction hardening of large gears provides a uniformly hardened surface from one tooth flank around the root and up the other flank without interruption. Eliminates points of thermal stress concentration. And there is no distortion, a problem of heat treated gearing that requires subsequent grinding.

This new, advanced Philadelphia method permits radical reduction in sizing and/or increased load carrying capacities. And it can easily harden even the largest spur, helical and herringbone gearing up to 180 inches in diameter, 20 inches in face, and 3/4DP.

Learn more about this new method for increasing the service life of your gear drives. Write for your copy of Bulletin 100.

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NEW BOOKS

A Bibliography of Crushing and Grinding. This book is written to help processing engineers in solving problems and increasing efficiency of crushing and grinding operations in plants. The first section of the book consists of short reviews on important aspects of crushing and grinding of raw materials for various chemical industries. The second section includes abstracts with annotations of 2,800 articles and books published since 1920. Published by Chemical Publishing Co. Inc., 212 Fifth Ave., New York 10, N.Y. 425 pp. Price $10.50.

Design of Steel Structures, by Boris Bresler, professor of civil engineering, and T. Y. Lin, professor of civil engineering, University of California, Berkeley, Calif. Emphasis is on the rational approach to the design of steel structures, based on both the elastic and the plastic behaviors of members and connections. Basic principles of mechanics are applied to the solution of structural problems, and structural design codes are discussed in light of rational analysis, empirical evidence, and practical requirements. Published by John Wiley & Sons Inc., 440 Fourth Ave., New York 16, N.Y. 710 pp. Price $9.75.

Trail Guides to the Upper Pecos, by Arthur Montgomery and Patrick Sutherland. A delightful pocket companion for anyone who wishes to take a trip through the wilderness area of the Upper Pecos River of New Mexico, or if you can't go, this will come as close to an armchair visit to the area as can be devised in print. Subjects include basic and elementary geology of the area, numerous photos, and commentaries. Published by the State Bureau of Mines and Mineral Resources, New Mexico Institute of Mining & Technology, Socorro, N.M. 83 pp plus area and geologic maps.

Geology of the Lynn Lake District. Publication 57-1, by G. C. Milligan. An exceedingly detailed and thorough geological study of the famous productive Lynn Lake area north of Flin Flon, Manitoba. Published by the Province of Manitoba, Dept. of Mines and Natural Resources, Winnipeg, Canada. 317 pp plus 16 maps and three cross sections. Price $2.

Asbestos Bulletin. Abstracts of recent articles and patents included in this publication pertain to mining, processing, asbestos-cement and reinforced plastics. This bulletin is published bi-monthly by Astex Publishing Co., 22/23 North St., Guildford, Surrey, England. Subscription rates are £9,15s per year including postage.

Canadian Mines Handbook. The new issue contains 24 pages of maps showing producing areas in color. Listings include histories, locations, holdings, developments, metals, ore reserves, head offices, mine offices, officers and directors. Published by Canadian Mines Handbook, Northern Miner Press Ltd., 116 Richmond St. W., Toronto 1, Ontario, Canada. Pp 300. Price $3 paperbound, $5 deluxe-bound.

Geology of the Lexington Quadrangle, Virginia, by Kenneth F. Bick. Chief mineral resources of industrial value in the area appear to be carbonate rocks. Iron ore, clay and manganese have been mined in the Lexington quadrangle, but the author implies that deposits of these minerals will be small and hard to find. Published by the Virginia Division of Mineral Resources, Charlottesville, Va. Pp 40 plus map.

List of Publications and Maps for Virginia, published by the Virginia Division of Mineral Resources, Charlottesville, Va. Pp 27.

Cesium. Uses, geology and mineralogy, metallurgy, prices, research and outlook for the light alkali metal, cesium, are presented in a booklet prepared by Chemalloy Minerals Ltd., which owns a substantial pollucite deposit at Bernic Lake, Manitoba. The booklet predicts that there will be a great surge in demand for cesium because of possible extensive applications in the cesium plasma thermocouple invented at Los Alamos, which produces electricity directly from atomic heat, use of cesium in rocket fuels, and ion-powered spacecraft. Copies of the booklet may be obtained from Chemalloy Minerals Ltd., Suite 1402, 80 Richmond St. W., Toronto, Ontario, Canada.

BOOKS presented on this page may be obtained directly from the publisher mentioned in each case. E&MJ does not sell books.

The Geological Map of New Zealand. by G. W. Grindley, H. J. Harrington and R. L. Wood, New Zealand Geological Survey. Profusely illustrated with aerial photographs. Published by the New Zealand Geological Survey as Bulletin 66. Available at Government Bookshop, 130 Oxford Terrace, Box 1721, Christchurch, N. Z. Pp 320. Price 60 s.

New Publications of the Bureau of Mines, Monthly List 542, June 1960. This five-page booklet lists all recent publications of the Bureau of Mines, free or for sale. It lists those publications which may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.; also listed are free publications which may be obtained from the Publications Distribution Section, Bureau of Mines, U.S. Department of Interior, 4800 Forbes Ave., Pittsburgh 13, Pa. Pp 5.

New Publications of the Geological Survey, List 623—Publications. Issued in June 1960. An extensive list of book reports, bulletins, topographic maps, and indexes, prepared by the U.S. Geological Survey, U.S. Department of Interior, Washington 25, D.C.

Gypsum Deposits Adjacent to the Great Northern Railway in Central Montana. Ten gypsum deposits that appear to contain sufficient reserves of good quality for commercial exploitation are described in a report released April 1960 by the Mineral Research & Development Dept., 204 Great Northern Bldg., Seattle 1, Wash.

The following publications of the Bureau of Mines may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at the prices stipulated:

Methods and Costs of Sinking a Circular Concrete-Lined Ventilation Shaft, by Lloyd Williams. I.C. 7955. This circular describes methods of sinking a 16-ft inside dia air shaft near Birmingham, Ala. Pp 31. Price 25¢.

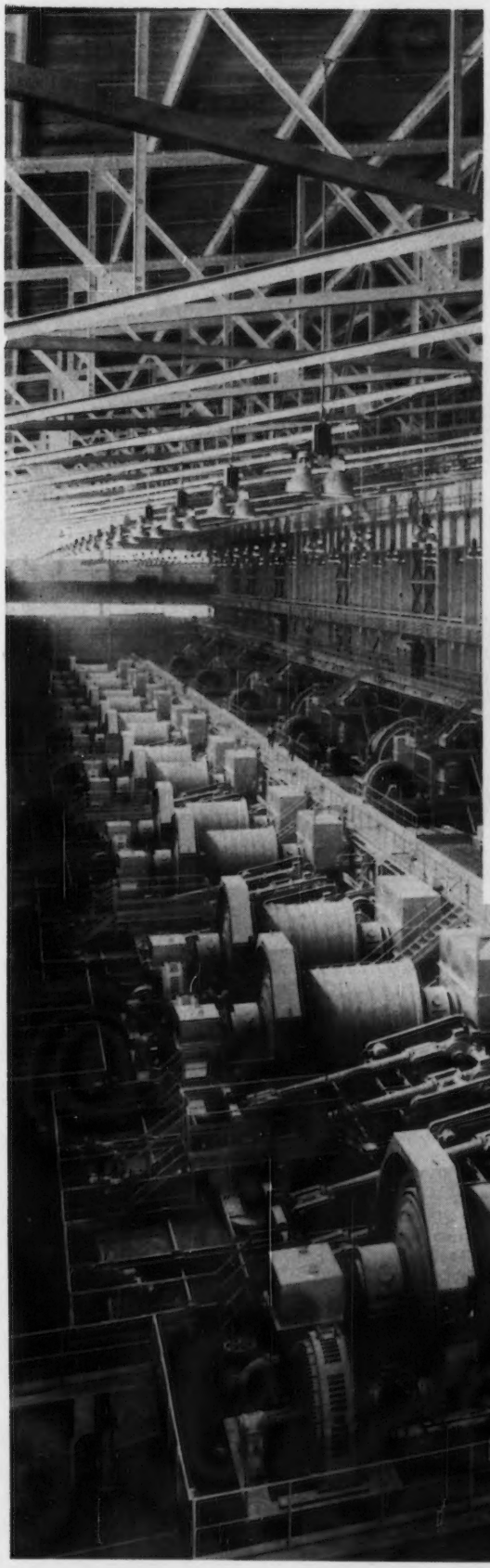
Permissible Mine Equipment Approved During 1957-58, by E. J. Gleim and F. R. Lee. I.C. 7957. Pp 27. Price 25¢.

Applications of a Small Electronic Digital Computer to Pyrometallurgical Research, by R. J. Leary, R. W. Smith Jr. and B. J. Mitchel. I.C. 7959. Problems described in the circular include calculation of heat content of pure iron over a wide range of temperatures, analyses of experimental blast-furnace operations, and other extremely difficult and complex metallurgical problems. Pp 26. Price 40¢.

A Guide to the known Minerals of Turkey. Revised by C. W. Ryan, mining engineer, Dec. 1957. Reprinted in April 1960 by the Mineral Research and Exploration Institute of Turkey and the Office of International Economic Cooperation, Ministry of Foreign Affairs, in cooperation with the U.S. Operations Mission to Turkey, International Cooperation Administration, Ankara, Turkey. This inventory of Turkish mineral occurrences includes a colored map locating occurrences of 42 different metals and minerals.

Chemical Processing Nomographs, edited by D. S. Davis. Chapter headings include methods of making nomographs, heat, flow of fluids, vapor pressures, pressure-volume-temperature relationships, solubilities, densities and specific gravity, viscosities, relative humidity, costs, sizing equipment, conversions, standard deviations and quadratic equations. Published by Chemical Publishing Co. Inc., 212 Fifth Ave., New York 10, N.Y. Pp 256. Price $12.

1960 Pick's Currency Yearbook, by Franz Pick. Major theme of the new yearbook is the world-wide erosion of monetary values. Of the 89 currencies included in the yearbook, 50 are due for wide-reaching adjustments or devaluation. Political developments in Africa may create at least a dozen new currencies. For the first time, data has been added on gross national product per capita. Another part of the book covers statistics and the world's leading gold markets. Published by Pick Publishing Co., 75 West St., New York 6, N.Y. Pp 600. Price $37.50.



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The plant that will effectively and economically implement your chemical or metallurgical process is one designed, engineered, erected, equipped and tested by Stearns-Roger engineers. Our service can save you months of lost time getting into production and avoiding trial and error in bringing operations up to design capacity. For over half a century Stearns-Roger plants have been known as the best that the technical skills can produce. When you begin to plan facilities, consult Stearns-Roger.

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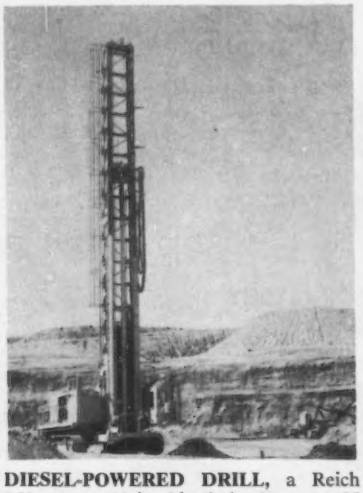
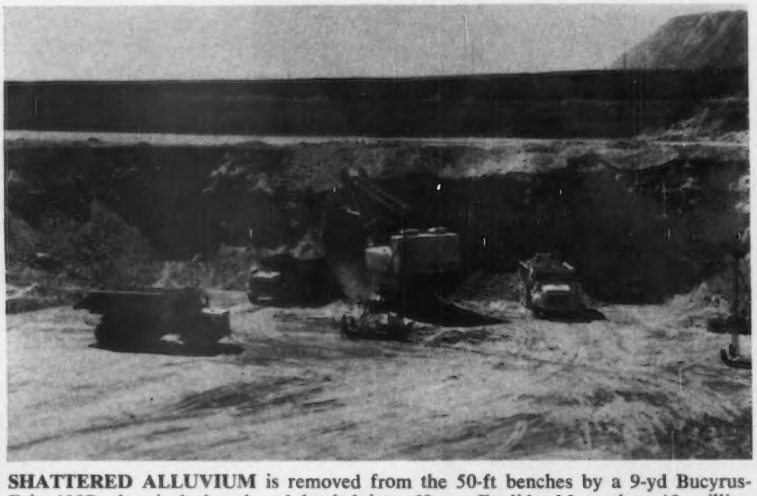
ENGINEERS • CONSTRUCTORS
MANUFACTURERS

MAINTENANCE SHOPS, warehouse, fuel lubrication station and machine shop are complete. The foundation for the secondary crushing plant at right already has cone crushers mounted. The $43.5-million project is expected to start production in 1962.



DIESEL-POWERED DRILL, a Reich 850, put a 12-in. blasthole down to 55 ft in one pass.



SHATTERED ALLUVIUM is removed from the 50-ft benches by a 9-yd Bucyrus-Erie 190B electrical shovel and loaded into 60-ton Euclids. More than 19 million tons of the necessary 46 million tons of overburden have been removed to date.

Asarco Moves Toward Mission's 1962 Deadline

DEVELOPMENT of the large open pit and construction of a concentrator and supporting plants—a $43.5-million project inaugurated by Asarco some 20 miles south of Tucson, Ariz., in late summer 1959—are proceeding at a rate that assures active production in 1962. Since stripping operations started more than 19 million tons of waste material have been removed from the pit out of the total of 46 million tons required to prepare the mine for a daily ore production of 15,000 tons.

The low-grade porphyry-type ore body under development lies under 200 ft of alluvium, consisting of gravel and wash. Exploratory work carried out since 1954 included extensive diamond drilling, and sinking of a 375-ft vertical shaft and 2,000 ft of underground workings, including a number of raises. The preliminary work was completed early in 1959, with the Mission ore zone well delineated. The pre-mining pit will be oval in shape, measuring 2,100 ft along the short axis and 2,500 ft along the long axis.

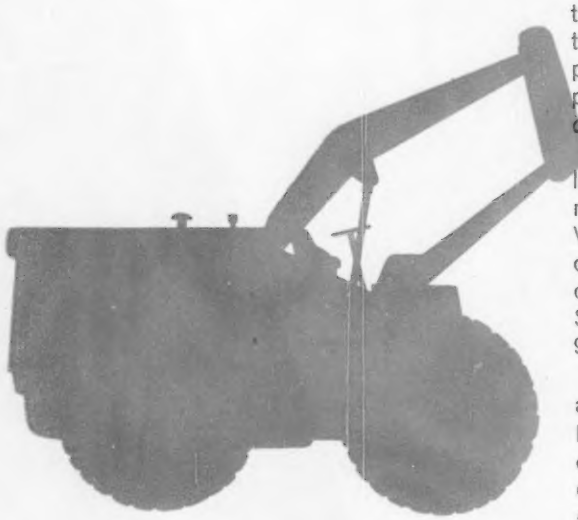
Actual stripping of the top alluvium is carried forward by earth-moving units. Each one consists of a full-revolving electric shovel with a 9-yd dipper, 60-ton trucks, and a large rubber-tired bulldozer to keep the area clear. Total shovel and truck equipment in operation consists of two B-E 190B shovels; two P&H 1800 shovels; and 29 Euclid R-55 diesel-powered trucks. An additional shovel is scheduled for delivery in the near future.

Benches in the alluvium are maintained at a height of 50 ft. They are first started with bulldozers with rippers and scrapers. The shovels take over when the height of the bench reaches 20 ft or more. In rock and in the ore zone the benches will be carried at 40 ft. The alluvium breaks easily, but to increase shovel output and reduce dipper teeth wear, drilling and blasting are practiced ahead of loading operations. Holes for bench drilling are put down on 33-ft centers to the next lower bench plus 3 or 4 ft. Distance between hole rows is 27 ft. The holes are 12 in. in dia, the drill used being a Reich 850 diesel-powered rotary unit designed to drill 55-ft holes in one pass. Innovations that have increased drilling speed, brought about rapid removal of drill cuttings, and longer bit life include the use of detergent during drilling, and the use in the alluvium of a two-wing bit in place of the conventional Tricone bit. The bits now in use are the original Tricone units, with one wing or cone removed at the base where the jet exits. The wing, with cutter thus removed, is stored for replacement of worn wings. Drilled holes

CUMMINS V DIESELS
MORE COMPACT
MORE POWERFUL

CUMMINS

ADDS A 700HP V12 DIESEL TO A GROWING LINE OF CONSTRUCTION ENGINES



Newest of the V diesels from Cummins is the VT12-700. A real workhorse. It's big in horsepower, but not in size. Truly the most compact, most powerful highspeed engine on the market. And turbocharging permits full rated horsepower up to 10,000 feet.

Like the VT-700, the new, naturally aspirated V12-525 has features that will reduce operating costs. Both 12 cylinder engines have internal fuel and oil lines which eliminate damage to exposed tubing and connections. The revised PT fuel system automatically compensates for wear—needs only the simplest maintenance. A basic block improvement gives you a stronger, more durable engine.

The increased power of these new diesels is a natural advance from the famed VT-600 and NVH-450. For more than ten years these two models have had the field to themselves. Only Cummins could better their proven performance. How? By redesigning the cylinder area to permit higher horsepower at no increase in engine size *or engine wear.*

This big bore feature is also part of the V diesels at the lower end of the line . . . the V8-350 and the VT8-430. All new, all power from the pan up, they're the first 8 cylinder V diesels in this horsepower bracket built specially for construction equipment. Every kind of application, every operating condition was considered in their design. Service is easy because all accessories are mounted in the 90° angle between the cylinder banks.

Be assured of continued low operating costs with Genuine Cummins Parts and qualified service. For the complete profit story, see your Construction Equipment Dealer or Cummins Distributor.

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6-17-60

V8·350 HP

VT8·430 HP

NVH·450 HP

V12·525 HP

VT·600 HP

VT12·700 HP

designed to solve a universal maintenance problem

MANUAL IMPACT WRENCH—
loosens the tough nuts
power wrenches can't budge!

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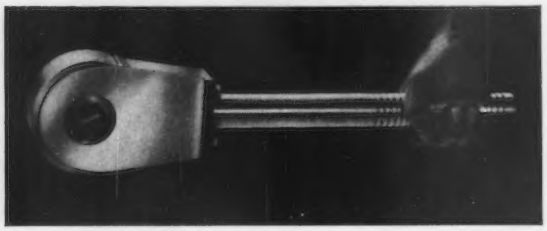


Model 750—for bolts ½" to 1¼" • Model 1000—for bolts ¾" to 1¾"
Model 1500—for bolts 1¼" to 2½"

- **Loosens "frozen" nuts in seconds**
- **Tightens nuts to maximum practical tightness**

SWENCH is an entirely new concept in wrench design. It is the world's *only manual impact wrench.*

NEW SPEED—Nuts that previously had to be burned off can now be "SWENCHED off"—with unbelievable ease—by *one* man—in a matter of minutes.

NEW EASE—Only SWENCH in its torque class is truly portable . . . lets you take the wrench to the job—*anywhere*—with no auxiliary equipment, no power connections.

NEW SAFETY—With SWENCH there's no back-breaking, knuckle-knocking struggle . . . no dangerous handle extensions . . . no sudden release of a frozen nut . . . no shock transmitted through the handle.

NEW POWER—SWENCH, size for size, gives greater—and more effective—torque than power wrenches . . . multiplies torque applied to handle over 1500% (yet all SWENCH's power is built into the wrench itself).

NEW ECONOMY—SWENCH saves in *many* ways . . . no auxiliary equipment to maintain and man, no costly upkeep on the wrench, no man-hours fighting frozen nuts—*and* SWENCH costs less than half as much as wrenches with comparable impact power.

NEW VERSATILITY—*One* SWENCH can handle more bolt sizes than any power wrench . . . loosening or tightening requires no special adjustments.

NEW TENSIONING ACCURACY—Precise tightening is assured with SWENCH, following simple instructions.

Write for further information and a quick and convincing demonstration.

"When you're up against the tough nuts . . .
Don't wrench it . . . SWENCH it!"

MARQUETTE DIVISION
CURTISS WRIGHT
CORPORATION • GALEWOOD DRIVE, CLEVELAND 10, OHIO

Mission *(Continued)*

are loaded in conventional manner and blasted with Primacord. About 650 ft of blastholes are drilled per shift. Powder efficiency averages 4.5 tons per lb of explosive.

Broken material is loaded by the shovels at a rate of 12,000 tons per shovel-shift. With eight shovel-shifts (three on day shift, three on swing shift, and two on graveyard) operated each 24-hr day, some 100,000 tpd of waste are removed from the pit. Haulage distance to the two main waste dumps, north and east of the pit, is about ½ mile, one way. Each dump is served by two 50-ft haulage roads, which eliminate merging of traffic. Maximum grade is 7%.

Construction of the 15,000-ton concentrator and auxiliaries, and other surface plant units, was started on March 1, 1960. Structures completed include a modern office building; machine shop; warehouse; truck maintenance and repair building; change house; fuel-lubrication station; water system; and others. All foundations for the primary and secondary crushing plants and concentrator proper have been completed, and erection of steel structures is underway. Western-Knapp Engineering Co. of San Francisco is primary contractor.

The plant site is now served by a 6-mile, standard-gage industrial railroad line, connecting with the Southern Pacific R. R. Tucson-Nogales main line a short distance north of Sahuarita. Elec-

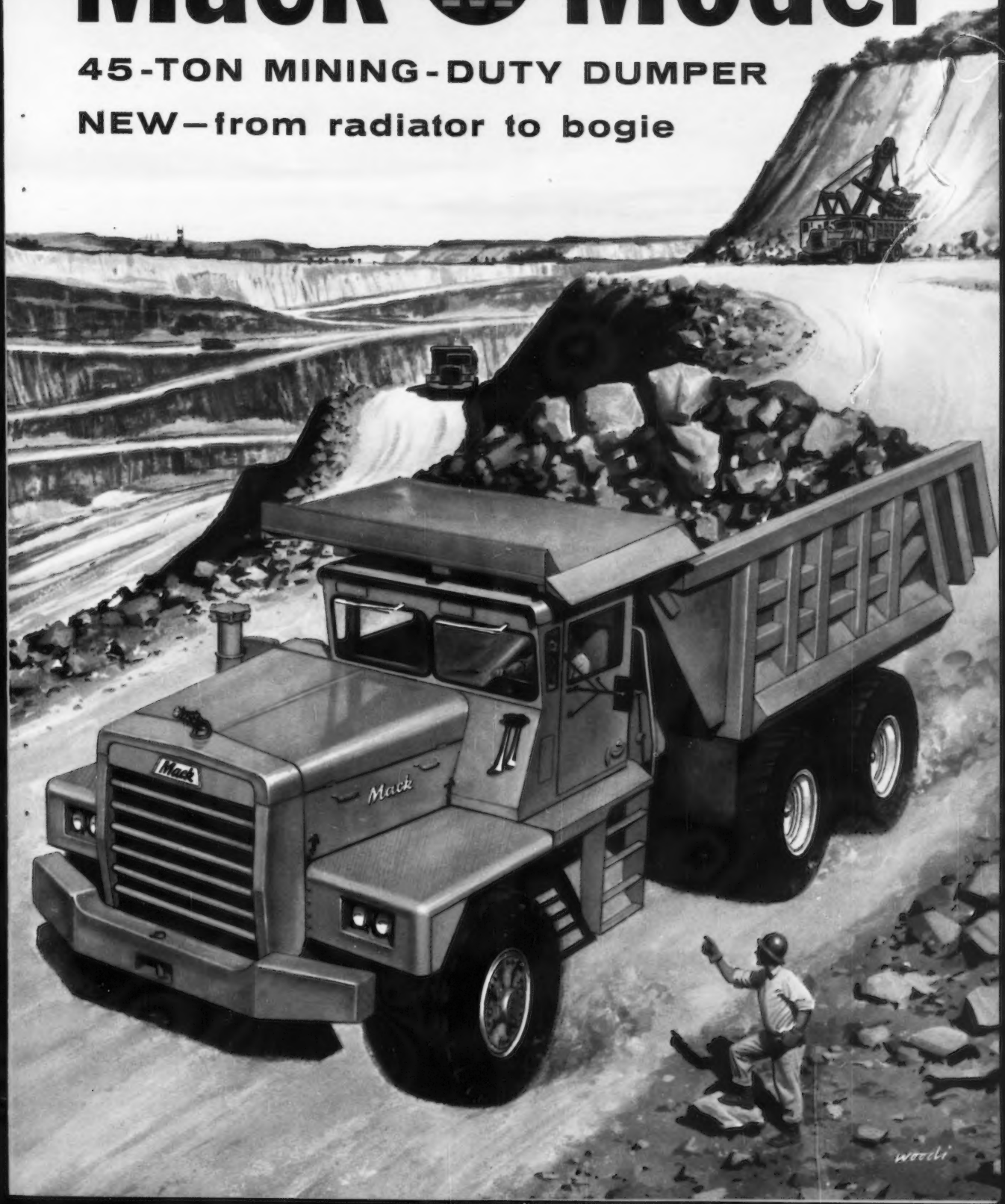
LESCHEN WIRE PORTER ROPE DIVISION
H. K. PORTER COMPANY, INC.

ANNOUNCING...

Mack Model

45-TON MINING-DUTY DUMPER

NEW—from radiator to bogie

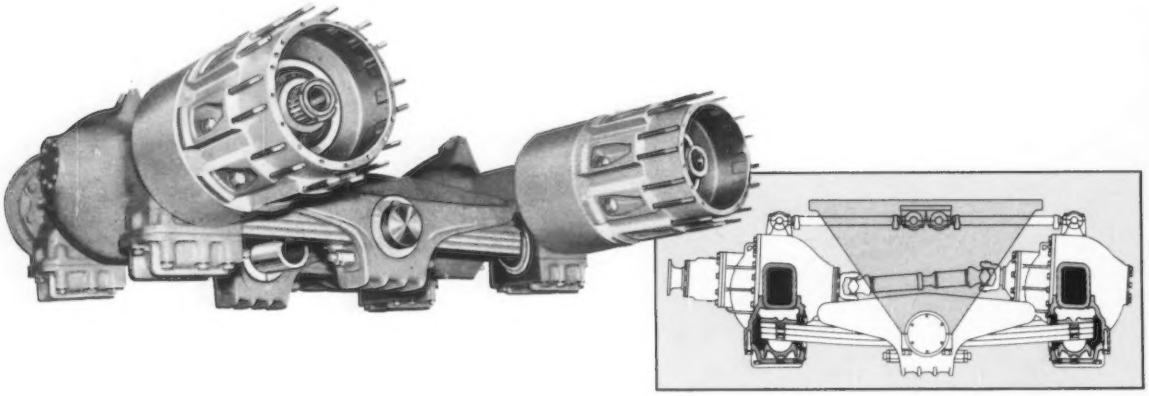


Mack Model

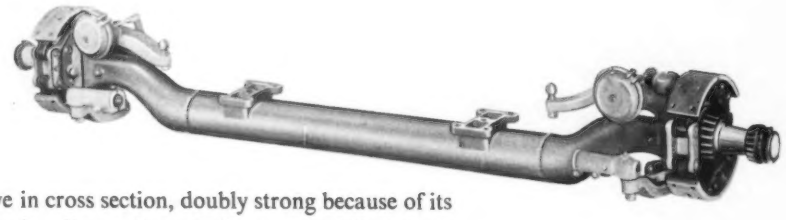
made for mining with mining-duty components

Meet the matchless Mack M Model—made to take in stride the heaviest hauling of the mining industry. Successor to the highly successful Mack Model LYSW, the new 45-ton M Model offers many of the proved features that won its predecessor a worldwide reputation for lowest operating costs and remarkably great freedom from downtime.

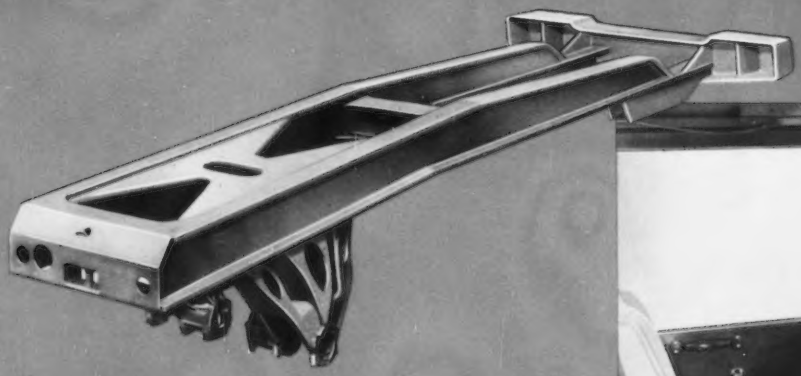
Add the new features shown on these pages, improvements that give still greater vehicle life and operating economy, and you have a vehicle destined to be first choice among users who demand the finest in heavy-duty hauling equipment.



New heavy-duty off-highway bogie. Unsurpassed for ruggedness and tractive ability and adding greatly to tire life, the newly designed Mack off-highway twin-axle bogie offers the strength and simplicity of straight-through drive and single-reduction carriers with Mack Planidrive reduction in the wheel hubs. Exceptionally long tire life is achieved through unusual bogie flexibility which also reduces twisting and wracking of the frame. Even with diagonally opposite wheels raised more than a foot each, this flexibility keeps all wheels equally loaded and the frame level. Suspension is through walking beam and flat leaf springs. In operation under load, the spring is in contact throughout the full length of the walking beam which contains it. Unloaded, the spring falls away from the beam to give as good a ride as when loaded. Spring ends are secured to the axles by rubber insulated rocker saddles which minimize friction, wear and rattling, cushion shocks and absorb vibration. Leaves are retained by wedges, thus replacement, if needed, is greatly simplified.

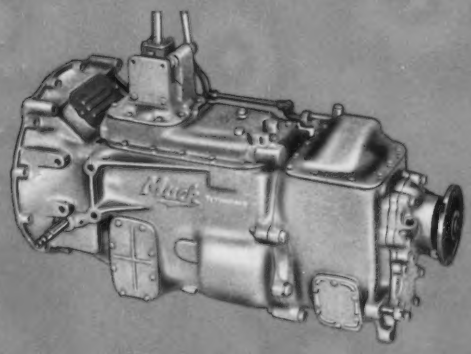


New 7″ tubular front axle. Massive in cross section, doubly strong because of its 7″ diameter tubular construction, the all-new Mack-built reversed Elliott front axle withstands the heaviest loads of extra-heavy-duty dumper-service. Wide in tread, it assures maximum stability and short turning radius.



Sturdiest, most durable frame you could ask for. Built to shrug off the jarring impacts of huge shovel loads, the all-welded special alloy steel frame of the Mack M-45 is of wide-flange I-beam construction. Three I-beam cross-members and cross corner gussets are welded to 16¼″ x 1″ main frame rail web to reduce stress concentrations in the flanges. Extra-rugged cast trunnion brackets are welded to web and 6″ x 1¼″ lower flange of main rails to avoid stresses in the flanges.

Designed to help you haul best. Modern in design, the new, bold lines of the Mack M-45 Model mark it as a truly functional heavy-duty dumper for the mining industry where huge loads are commonplace. Cab's reverse-slope windshield reduces glare and reflection . . . reduces dirt and dust accumulation. Cab doors are piano hinged for maximum strength, and the cab interior is double vented for driver comfort. New offset cab provides commanding view fore and aft for faster cycling, easier spotting and safer operation. Forward cab position permits shorter front-axle-to-back-of-cab dimension, so more weight can be shifted to newly designed larger capacity front axle without sacrificing cab roominess. Gages and instruments are conveniently grouped for visibility and quick reading.



Evenly-stepped, easily-shifted Mack Duplex transmission. Mack's exclusive two-lever eight-speed Duplex transmission, with air-assist clutch, matches perfectly the power output of the 450 hp diesel engine that powers the M-45, provides the proper ratios for heavy-duty service, and features exclusive Tetrapoid gears which are stronger, longer-lived and quieter than conventional gears. Gears are helical for easier shifting and quietness . . . involute transmission splines provide greater stamina and durability. Optional torque converter drives are also available.

Mack Model

Built to mining specifications

PAYLOADS: Rear dumper, 45 tons

WHEELBASE: 208"

PLATFORM LENGTH: 194"

OVER-ALL LENGTH: Front bumper to end of body, 380"

DIESEL ENGINES: 420 hp to 525 hp, 12-cylinder diesel engines

COOLING SYSTEM: 2330 sq. in. frontal radiator, continuous finned, flat tube; bolted top and bottom tanks; rubber mounted on center trunnion

ELECTRICAL SYSTEM: 12-volt, 40-amp.

STARTING: Air

TRANSMISSIONS: Mack, selective, constant-mesh, 8 speeds forward, 2 reverse; converter and Mack 4-speed transmission; Torqmatic converter. Optional integral hydraulic brake on torque converters

CLUTCH: Two-plate, air-assist with manual actuation

FRONT AXLE: Mack, heavy-duty tubular welded to cast ends

REAR AXLES: Mack off-highway walking beam bogie, single-reduction through-drive and Mack Planidrive, with final reduction through planetary gears within wheel hubs; inter-axle Power Divider

BRAKES: Front, air; rear, air-hydraulic; all rear wheels with separate air and hydraulic cylinders to prevent complete loss of braking in event of failure at one wheel; 12 cu. ft. compressor

FRAME: Alloy-steel, wide-flange I-beam, 138 section modulus

STANDARD BODY: Heavy-duty 100,000 psi alloy steel

CAPACITY: Struck, 28 cu. yd.; heaped SAE rating, 36.5 cu. yd.

SPRINGS: Front, semi-elliptic vari-rate, 3-leaf radius rod; rear, flat leaf in walking beam, suspended in rubber insulators

WHEELS: Cast, spoked

TIRES: 18.00 x 25, 24-ply tubeless on 13.00 rims

STEERING: Hydraulic power steering, 37½' turning radius

DUMP HOIST: Twin, double-acting, outboard mounted, three-section telescopic cylinder assembly, providing 65° dumping angle

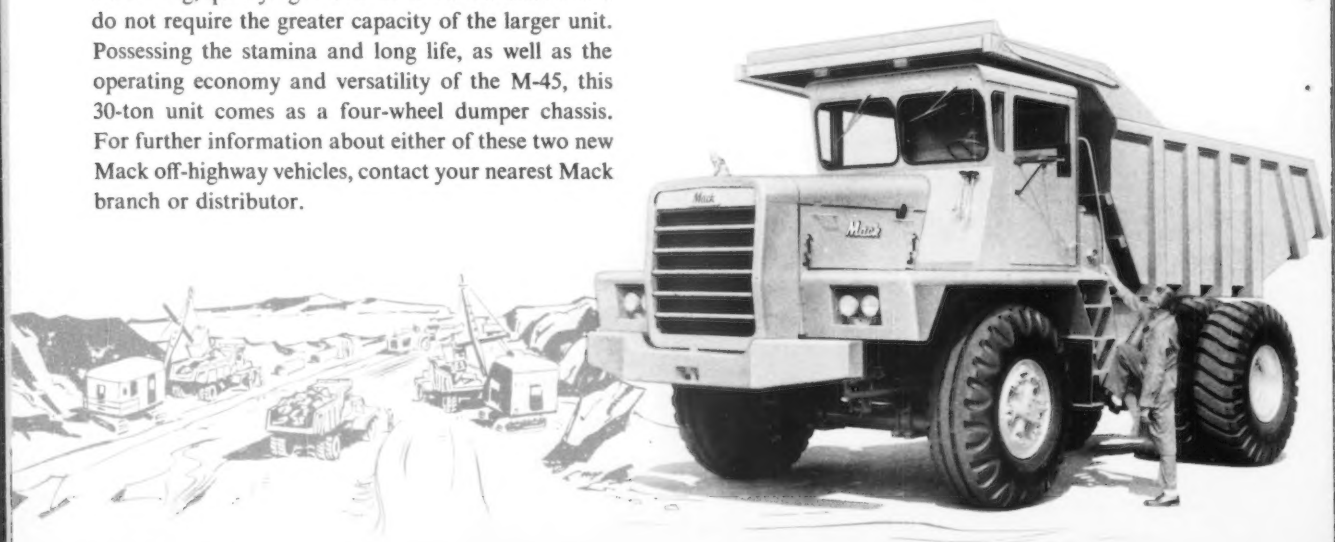
POWER TAKEOFF: Mack, 50 hp

OPTIONS: Heated body, rock ejectors

MACK FIRST NAME FOR **TRUCKS**

Mack Trucks, Inc., Plainfield, New Jersey • Mack Trucks of Canada, Ltd., Toronto, Ontario

Peerless performer—the 30-ton M Model. Mack M-30 Model, companion to the M-45, is offered to those in the mining, quarrying and construction industries who do not require the greater capacity of the larger unit. Possessing the stamina and long life, as well as the operating economy and versatility of the M-45, this 30-ton unit comes as a four-wheel dumper chassis. For further information about either of these two new Mack off-highway vehicles, contact your nearest Mack branch or distributor.



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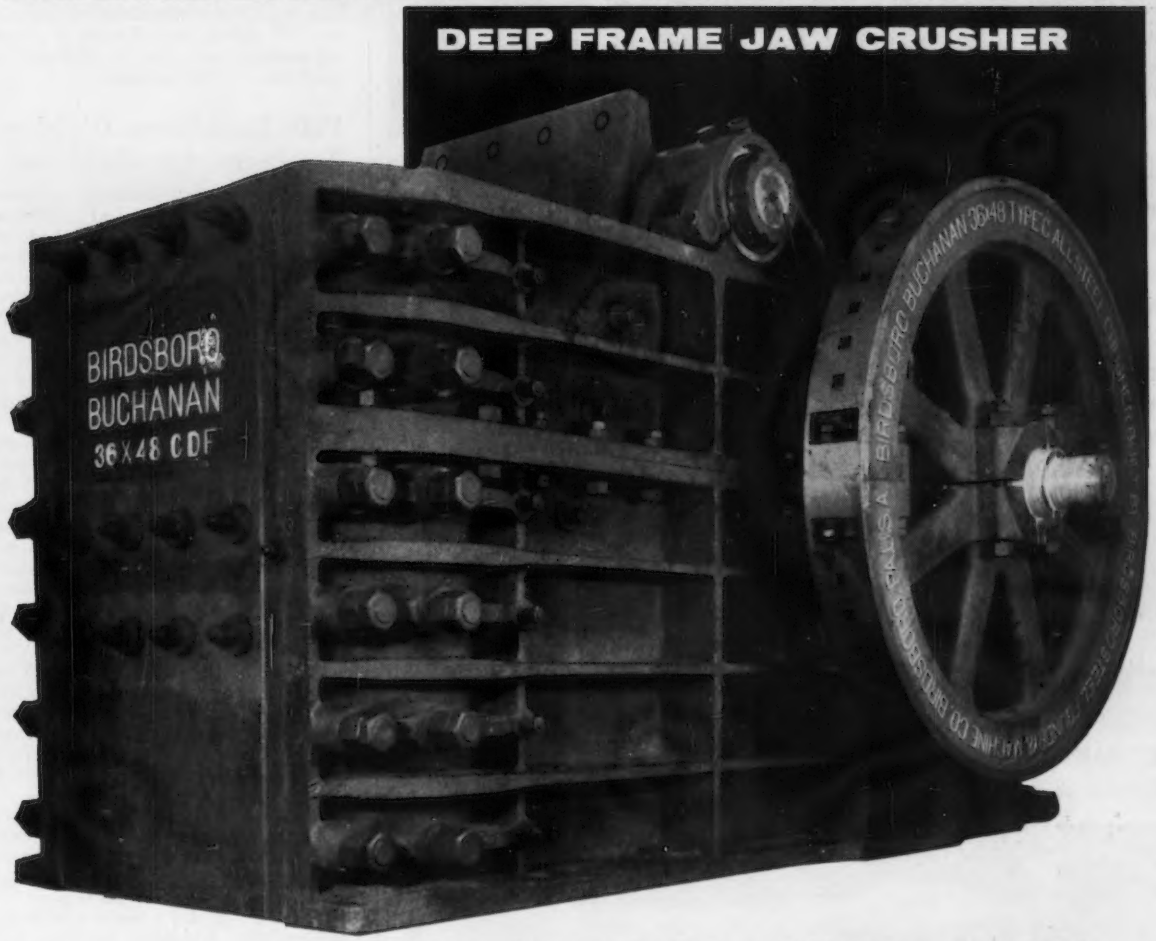
A GOOD NEIGHBOR
MAKES A GOOD CHOICE

BIRDSBORO · BUCHANAN

DEEP FRAME JAW CRUSHER



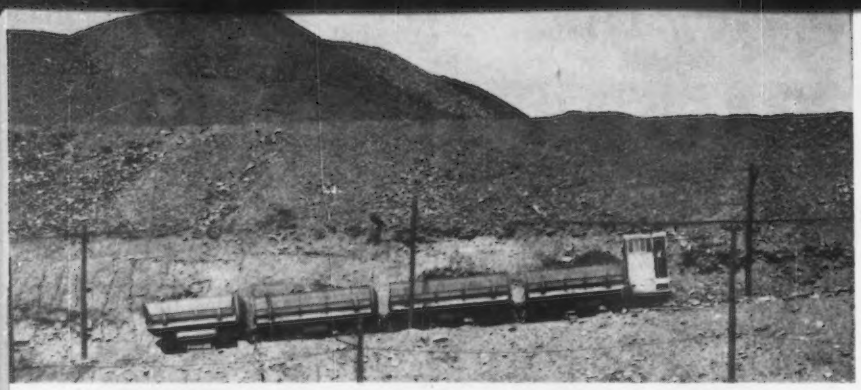
- At a large base metals site in a neighboring country, there's a Birdsboro 36″ x 48″ crusher yielding new production economies. Our neighbor-friends chose Birdsboro because the job was a tough one: reducing ore for production of copper, lead and zinc concentrates, as well as pyrite concentrate for acid makers.

You'll find Birdsboro crushers a good choice *this* side of the border, too. Our representative is ready to tell you why.
Sales Department, Engineering Department and Mfg. Plant: Birdsboro, Pa., *District Office:* Pittsburgh, Pa.
Canadian Representative & Manufacturer: John Inglis Co., Ltd., Toronto, Canada.
World-Wide Agent Representation. Contact home office for nearest representative.

CR 30-60

BIRDSBORO CORPORATION

STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • ROLLS • ELECTRIC STEEL CASTINGS: Carbon, Low Alloy and STAINLESS STEEL

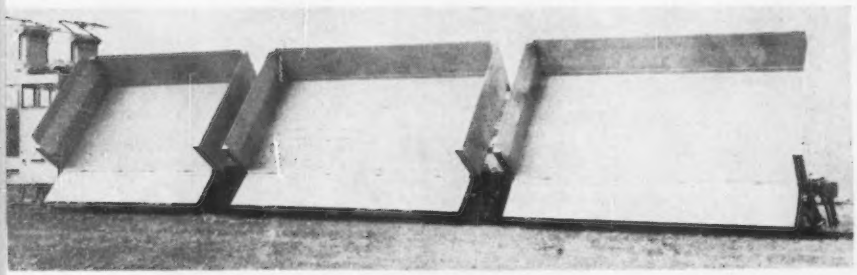


DIFFERENTIAL steep grade rail PACK TRAIN®

Up and down a 10% grade with DIFFERENTIAL ELECTRIC WHEELS for 13 years without an accident.

Uses trolley for fast climbing up 10% grade. Small auxiliary diesel-electric generator may be used for level track. With steel wheels on steel rails, tractive effort required is 5# per ton on level track, and 205# per ton up 10% grade.

Controlled speed with electric braking down 10% grade. Saves brake shoe and wheel wear.



PACK TRAIN uses rail all the way for lowest transportation cost. Dumps to either side all at once or one at a time.

DIFFERENTIAL two-way side dump WAGON TRAIN

A convenient way to unload. 45 ton highway train (15 tons in each wagon). 90 ton off-highway train (30 tons in each wagon). Light weight trains haul heavy loads.

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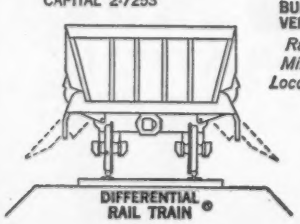
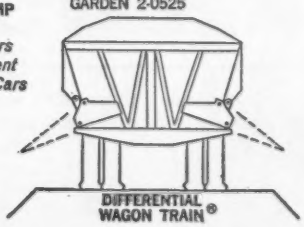
BUILDERS OF SIDE DUMP VEHICLES SINCE 1915

Railway Air Dump Cars
Mine Haulage Equipment
Locomotives and Mine Cars



PATENTED



Mission (*Continued*)

tric power is obtained from Tucson Gas Electric Light and Power Co. Members of the Asarco staff in charge of the Mission Project include T. A. Snedden, manager, Southwestern Mining Department, Asarco, and R. B. Meen, superintendent. Engineering design is directed by E H. Scheik, asst. director of central engineering, with W. R. Mahoney as chief construction engineer.

PHS Establishes Division To Fight Air Pollution

"THE CONTINUED EMPHASIS on many personal, community and industrial activities which contribute to both intensity and complexity of air pollution, and the continued trend toward concentration of our population in metropolitan areas, make it clear that the nation-wide threat of air pollution is becoming greater," said Surgeon General Leroy E. Burney, in announcing creation of a new Division of Air Pollution in the Public Health Service.

The new division will consolidate the research, technical assistance, and training activities carried out since 1955 by the air pollution engineering and medical programs. Vernon G. MacKenzie, former assistant chief, research and development, Div. of Engineering Services, was named chief of the organization. He enters his post with more than 10 yrs. of experience in the field of air pollution.

By bringing all public health work on the problem into one division, it is expected the PHS will be able to coordinate more efficiently its medical and engineering liaison with state health departments, industries, universities, and other private and governmental groups.

Staff will include physicians, sanitary engineers, physicists, chemists, and professional specialists who have previously been working in separate medical and engineering units of the Service.

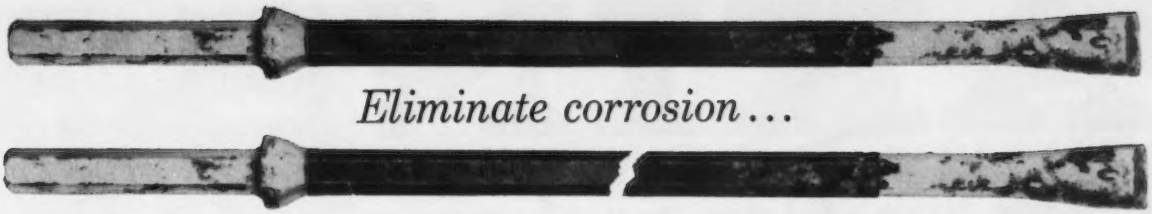
Research will play a major role in the division. Two laboratory branches will be established: one to deal with medical research and some phases of agricultural research, and the other responsible for research into the nature and sources of air pollution, its effects on the physical environment, and methods of controlling it.

Labor Section of Survey Law Goes to State Courts

THE BUREAU of Land Management has thrown to the state courts interpretation of the federal act that permits geological, geochemical and geophysical surveys to be used for annual labor requirements.

"The question of what would or would not be acceptable as assessment work, or any limitation or qualification placed on this statute, would come from the state courts having occasion to review or interpret this law, and not from this bureau," said Bureau Director Edward Woozley.

Woozley pointed out, however, that



Eliminate corrosion...

for lower drilling cost...

with **SANDVIK Coromant** *SR-Treated Integral Steels!*

- Corrosion promotes breakage: You know, of course, the variety of mechanical stresses to which steels are subjected in work. Stresses cause fatigue; can cause premature rod breakage, before the normal tensile strength or even the yield point has been exceeded.

  In most cases, fatigue failure starts from the point where corrosion has set in. In other words, corrosion sets up the conditions for a fatigue break to occur. Except—when you use Sandvik Coromant Integral Steels! The exclusive Sandvik SR-treatment* protects against corrosion and provides from 30 to 50% longer life than untreated steels.

  You get other advantages too: Less loss of energy, since the bit is integral with the steel. There is no bit to "get lost". What's more, since Sandvik is one of the world's largest manufacturers of tungsten carbide, you get bigger and better inserts.

  Sandvik Coromant Integral Steels are available from 1" to 1¾" bit diameter, in ¾", ⅞", and 1" hexagonal steel section.

  Write today for complete information. Address: Dept. EMJ-15.

Appearance of a fatigue breakage that often arises with rods that have not been protected against corrosion. Sandvik's SR-treatment* protects against such failures.

*pat. pend.

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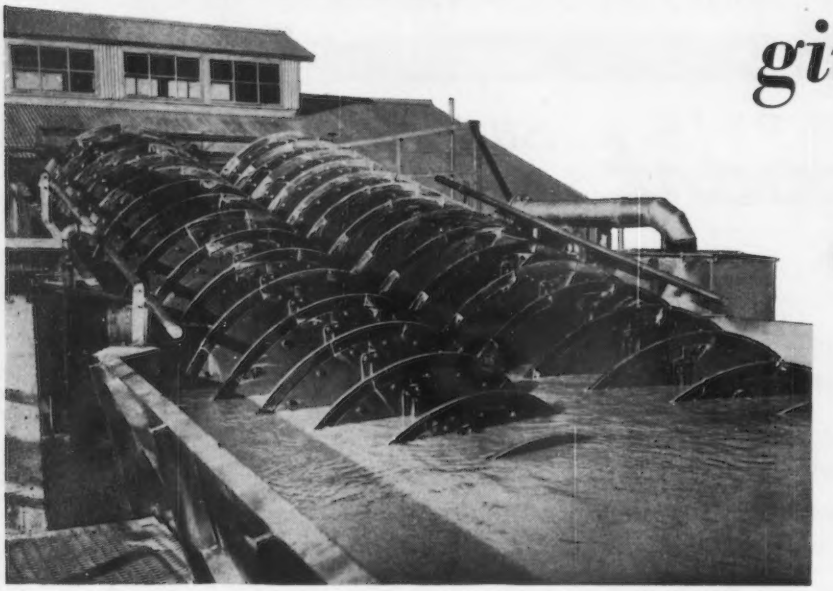
AKINS...

more *working* pool area per dollar



gives lower cost

- **dewatering**
- **recovery of fine solids**
- **sand-slime separations**
- **closed-circuit grinding**

Other Exclusive Akins Features...

- **starts without unloading**... mechanical lifting mechanism permits raising spiral when shutting down, and starting up again without unloading tank
- **submerged bearing** gives trouble-free operation, low maintenance.
- **lubrication** through pipe in main shaft assures positive flush lubrication of all bearing components
- **half-diameter spiral pitch** gives maximum raking capacity, minimum slippage and wear
- **overflow box** with pipe fitting is furnished as standard

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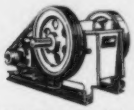
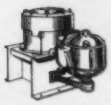
Laboratory Equipment



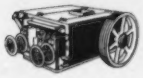
4"x 6" Massco Laboratory Jaw Crusher

Welded steel frame; manganese steel jaw and cheek plates; bronze bushed bearings; smooth jaws give better product and easier cleaning. Adjust for plate wear and product size by convenient hand wheel adjustment.



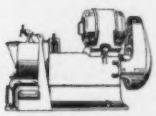
6" and 10" Massco Gy-Roll Reduction Crusher

Reduces ½" feed to as fine as 10 mesh in single pass. High capacity, low power consumption.



Laboratory Crushing Rolls

Sizes (Diameter x width): 8"x 4", 10"x 6", 10"x 8", 12"x 10" and 12" x 12". Adjustable roll space setting up to ¾". Double V-belt drive. Heavy, cast Meehanite frame absorbs vibration, results in long life.



Massco-McCool Pulverizers

Disc type grinder with a planetery movement. No gears. Will grind ¼" to 150 mesh in one pass.

Marcy Pulp Density Scale

Gives direct reading of weight; specific gravity of liquids, pulps, and dry solids; percent solids in pulp. Very accurate. Easy to clean.

MINE AND SMELTER SUPPLY CO.

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OFFICES AND AGENTS IN PRINCIPAL CITIES

Labor (*Continued*)

to date there has not been any amplification or determination by the courts of the law that includes surveys in the definition of "labor". He added that the legislative history and the reports on the hearings held in connection with the legislation, would be the best source of reference at this time.

Public Law 876, which contains the labor stipulation, was passed in 1958. This act requires that geological, geochemical and geophysical surveys be done by qualified experts and verified by a detailed report filed in the county office in which the claim is located. Such surveys are limited to two consecutive years and to a total of not more than five years on any one mining claim. Also, each survey may not be repetitive of any previous one on the same claim.

Wisconsin Seeks New Taconite Development

WISCONSIN GOVERNOR Gaylord Nelson and other state officials have conferred with mining industry officials on the outlook for taconite iron ore development in northern Wisconsin. Representatives of U.S. Steel Corp., Oliver Iron Mining Div.; Snyder Mining Co.; Ashland Mining Corp.; and Pickands-Mather & Co. attended a meeting to discuss iron ores and their part in the economy of the state

The governor said, "Representatives of companies present told us of their interest in exploration of Wisconsin iron-bearing formations, and of their laboratory tests of engineering problems in producing a marketable product. I was told that many factors, such as transportation costs, the condition of the steel market, competition from other ores, processing costs, and many other considerations affect the rate of mining development here."

Nelson pointed out that while exploration is going on over a wide area, no one was able to make an estimate of when commercial development was likely to start. In 1959 the state legislature passed a law designed to encourage taconite development by insuring mining firms of the water needed in processing the ores.

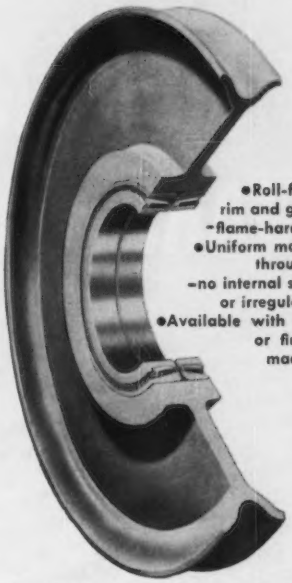
Two French Firms Adapt New Aluminum Process

TWO FRENCH FIRMS are jointly constructing a pilot plant, scheduled to open by the end of this year, to produce aluminum by a new process that eliminates the alumina stage.

This announcement comes on the heels of the report from Aluminium Ltd. of a similar $4-million operation now under construction at Arvida, Que. (E&MJ, August 1960, p 19) The French companies, Pechiney and Ugine, spent over 10 years investigating several new

Now A BETTER WIRE LINE SHEAVE

IDECO® FABRIFORM SHEAVE



- Roll-forged rim and groove –flame-hardened
- Uniform material throughout –no internal strains or irregularities
- Available with rough or finished machined hubs

- COMPLETELY FABRICATED FROM PLATE STEEL
- INHERENTLY DYNAMICALLY BALANCED
- STRONGER THAN CAST SHEAVES
- NO HIDDEN DEFECTS
- STANDARD SIZES, 24" to 55" O.D. — LARGER SIZES ON ORDER
- ROLL-FORGED RIM
- NO PATTERN COSTS
- HIGHEST QUALITY — NO HIGHER COST

WRITE FOR BULLETIN FS-6A

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■ Your product has to be best . . . and so do your screens. Your present equipment can be equipped with Bee-Zee Screens, round-rod as shown above or in any of the special rod shapes shown below. Screens are all-stainless-steel and *all-welded*, with electronic control spacing the rods precisely. Find out how Bee-Zee Screens turn problems into profit—to make you money. Wire, write or phone Galesburg DIckens 2-5154 collect.

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Bee-Zee Screens in a wide variety of shapes and sizes meet the needs of leading firms in the coal, minerals, quarry, oil, food, chemical, plastic, brewing, distilling, pulp and paper, rubber and other industries.

processes before agreeing to enter production on one of the plans.

Main advantages of the technique, say Pechiney and Ugine, are reduction in production costs and substantial reduction of the investment cost per ton capacity as compared to that for the Bayer-Heroult process. Initial output of the new plant will be between 3,000 and 5,000 tpy.

Meanwhile in Australia researchers at the Division of Mineral Chemistry have concluded preliminary costing work for a new acid process in the production of alumina from a number of raw materials. This method has already shown promise of being readily applicable to clays and aluminous laterites and, if the high cost for the special corrosion-resistant equipment can be overcome, the technique may replace the Bayer extraction process. The method to be used in the Canadian and French operations employs bauxite of roughly similar grades to that required in conventional production of commercial aluminum.

Rainier Atom Blast Shows Future In Nuclear Mining

ACCORDING to two mining experts, the Rainier underground atomic explosion set off by the Atomic Energy Commission in October 1957 shows that as much as a million tons of ore might be crushed in a single nuclear detonation with no release of radioactivity at the surface.

Lysle E. Shaffer, professor of mining at the University of California, and W. G. Flangas, mine superintendent for the Reynolds Electric and Engineering Co., conclude in a study of the Rainier shot published recently that nuclear explosives could profitably be used in conjunction with block-caving mining techniques. They claim that in such a setup the main body of ore would be slightly contaminated, but the radiation levels would be below occupation levels, and the value of the ore would be unaffected.

Here's how Shaffer and Flangas would operate an atomic mine. In an actual job there would be two separate drifts, one in which to place the nuclear explosive and a second, some 60 to 100 ft higher, to serve as the working level for the removal of crushed ore. Both drifts would be driven prior to the detonation, and the work after explosion would involve only minor repairs and development of short drifts into the collapsed zone for ore withdrawal.

The placement of the mining openings some distance above the point of detonation would provide freedom from radioactivity above acceptable levels either in the openings or in the ore recovered. In certain types of formations, say the engineers, it should be possible to crush about a million tons of ore with a single nuclear blast.

Cost for a nuclear explosive equivalent to 2,000 tons of TNT is about $500,000, including AEC charges for transporting, installing and firing the de-

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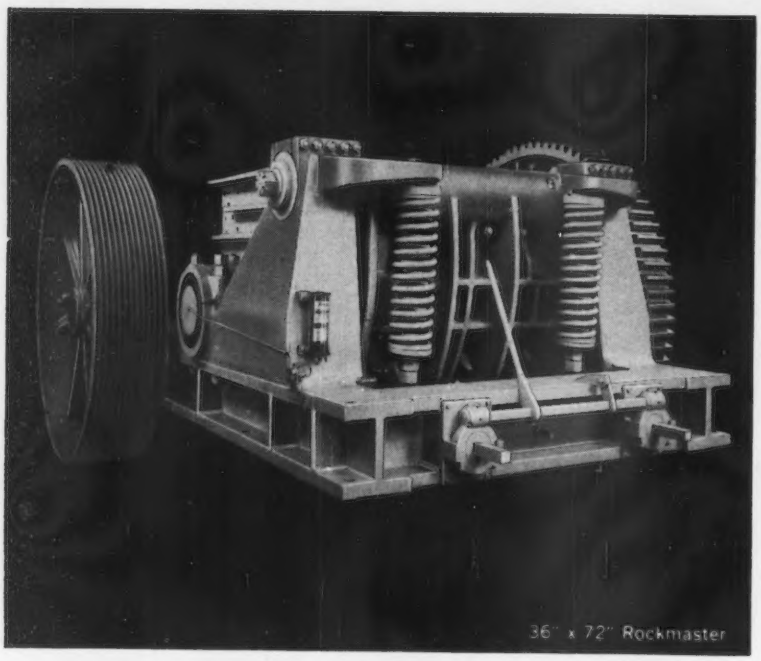

Widely used for primary and secondary crushing on the hardest and toughest kinds of shovel-loaded rock and ore, Rockmasters have high capacities and extraordinary ratios of reduction. Also they are the world's finest crushers for wet and sticky feed. Among outstanding design features: Automatic Steelstrut Toggle for release of tramp iron, and Quick-Adjustment for controlling size range.

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Rainier *(Continued)*

vice. According to the Rainier study, conventional mining costs would be higher. This differential means that low-cost recovery of certain types of ore through the use of underground atomic explosions is a definite possibility for the future, the mining engineers predict. (See E&MJ, June 1960, p 221.)

Uranium Mill Pact With Texas-Zinc Set

STANDARD METALS Co., Moab, Utah, has signed a uranium ore-milling agreement involving over $20-million for Texas-Zinc Minerals Corp. to act as agent in selling U_3O_8 to the Atomic Energy Commission.

AEC gave Standard an allocation of almost 3 million lb of uranium, and the firm will produce ore between July 1, 1960 and Dec. 31, 1966. After that, the company receives $8 per lb. Texas-Zinc has agreed to a scale of milling charges involving these two periods.

The Moab firm has approximately 5 million lb of U_3O_8 in existing reserves at its Big Buck mine, Big Indian District, part of which Texas-Zinc will accommodate in its over-all commitments with AEC.

In order to make up the difference between concentrates contracted for with the Commission and those gained from controlled sources, Texas-Zinc is conducting a drilling campaign for new ore in the Monument Valley area of northern Arizona. This exploration is unique in the industry.

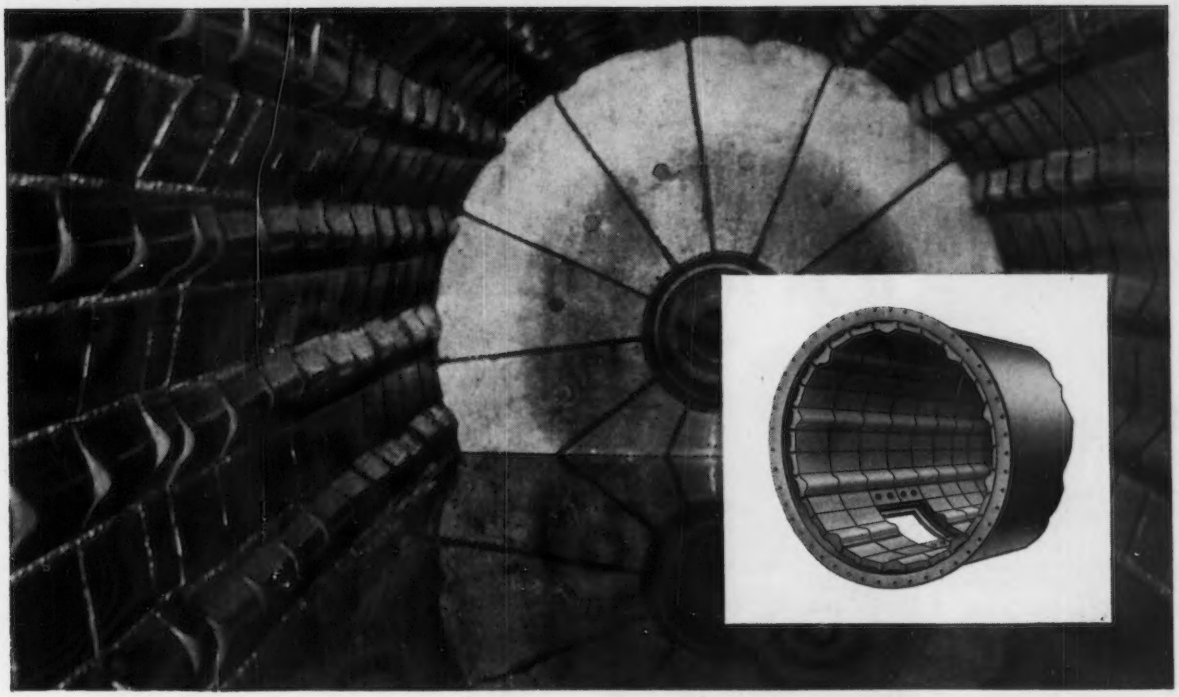
Concerning the Standard contract, Neill Banks, president of Texas-Zinc, said the agreement would "not squeeze out" small producers in the area, as some of them had claimed. He said the Mexican Hat mill would continue to allocate 50% of feed input to these producers.

Gas Hills Uranium Revamps Plant Capacity

FEDERAL URANIUM - GAS HILLS PARTNERS will build a $180,000 modification to its uranium processing mill in the Gas Hills area, Wyo., to increase plant capacity from 529 to 800 tpd.

Cotter Ferguson, president of Gas Hills, announced at a stockholders' meeting that the added capacity should make it possible to make up production of yellow cake during the fiscal year to meet the $529,000 a month concentrates sales contract with the Atomic Energy Commission. The modification is scheduled for completion by late October.

At the meeting, Ferguson also reported that Gas Hills drilling in the Shirley Basin area has uncovered what appears to be a major ore body, between 100 and 150 ft deep and shallow enough to be mined by open pit methods. Gas Hills has a 40% interest in the year-old mill, located near the Natrona-Fremont County line.



8 Reasons Why You Should Standardize with B&W Universal Liner Plates

Better Performance with Lower Costs—Same Casting Fits All Mill Sizes

B&W Tube Mill Liners reduce capital, time and labor costs. Consequently, they reduce the cost of the material ground. Here are eight reasons why:

1. Lower Initial Costs—standardization eliminates chiller and pattern costs.
2. Longer Life For Liners—better quality control on a mass production casting, utilizing permanent molds, results in uniform wear. Ideal size for uniform chill and heat-treatment.
3. Longer Life for Different Applications—this is assured by selection of proper materials. Design is suitable for either chilled irons or wear steels.
4. Reduced Costs in Both Direct Labor and Outage—installation time is less because small size and weight of castings allows them to be handled easily, without cranes and with less fatigue for workers.
5. Reduces Costs in Storage Space—because small castings stack easily, little storage space is required. One design of casting interchangeable for all size mills also simplifies records.
6. Reduced Costs in Liner Inventory—standardization is possible because one design fits all diameters of mills. Standardization means quicker unloading and storage.
7. Reduced Costs on Breakage Claims and Delays for Replacements—small castings are rugged and almost impossible to break by handling. Large castings of hard, brittle irons sometimes break in shipment.
8. Reduced Costs in Determining Most Efficient Wear Patterns—you can get wear profiles consisting of all lifter ribs or all flats from the same castings, as well as a combination of both including straight or spiralled lifter pattern.

Liners are supplied in two nominal thicknesses, 1½″ and 3″ with 1½″ high lifters. Castings are 6″ wide x 12″ long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates write The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W

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S-471

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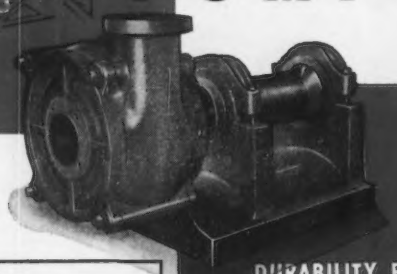

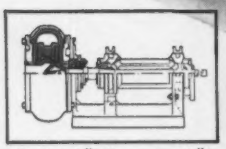

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Geiger Readings Ruled Proof for Uranium Claims

RADIOMETRIC READINGS, when coupled with other geological information and test drill holes, are sufficient proof for validating uranium claims, according to a ruling of the Wyoming Supreme Court.

The decision affirmed a Fremont County district court ruling that awarded Ralph H. Thurston title to 13 contested XYZ claims in the Gas Hills area.

Thurston had brought action against Roy Peck, Leigh Roush, and Washakie Exploration Co.; however, Western Standard Uranium Co. acquired the rights of all three before the trial.

In the decision, the court cited several other state supreme court rulings on use of radiometric devices, and concluded:

"While no case examined allowed the predication of a discovery solely on radiometric readings, the importance of such readings when taken into consideration with other facts and factors is universally recognized."

OME Contracts

DEPARTMENT OF THE INTERIOR has announced that its Office of Minerals Exploration has o.k.'d three more mineral exploration contracts. Besides the $37,720 Vitro Minerals Corp. agreement for beryllium search previously reported (E&MJ, September 1960, p. 192), OME

LESCHEN WIRE PORTER ROPE DIVISION
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NEW
MOBILE DRILL
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the first truly PORTABLE MULTI-PURPOSE ROTARY DRILL

First of its kind with "big rig" rotary drive for fast, economical subsurface exploration and production drilling in soils, rock and concrete. Precision engineered of tough, high-tensile alloys for lightweight strength, easy handling and all around utility.

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- Concrete drilling
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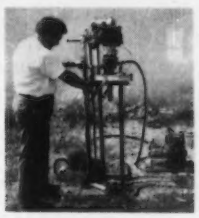
Versatile MINUTEMAN handles augers from 3″ to 12″ in diameter; drives 6″ diameter augers to 30′ depths. Total price for MINUTEMAN Basic Auger Package . . . complete with all tools needed to auger 3″ diameter holes 25′ deep and handle jobs marked (*) above . . . only $1,485 F.O.B. Indianapolis.



◀ **When equipped for core drilling,** the MINUTEMAN drives EW core barrels to 200′.

When equipped for concrete drilling, the MINUTEMAN extracts cores from 1" to 8" in diameter. ▶

MINUTEMAN features include: 6.5 HP engine • Twin shafts, 8-speeds • Diaphragm carburetor for any-angle drilling • Power or manual feed both in and out of hole • 44″ continuous stroke • Wheel mount • Lock Grip vertical or horizontal anchoring • Easily adapted for truck or trailer mounting.

MINUTEMAN 4-page brochure gives specifications, tool options and operating features. Write today for your copy . . .

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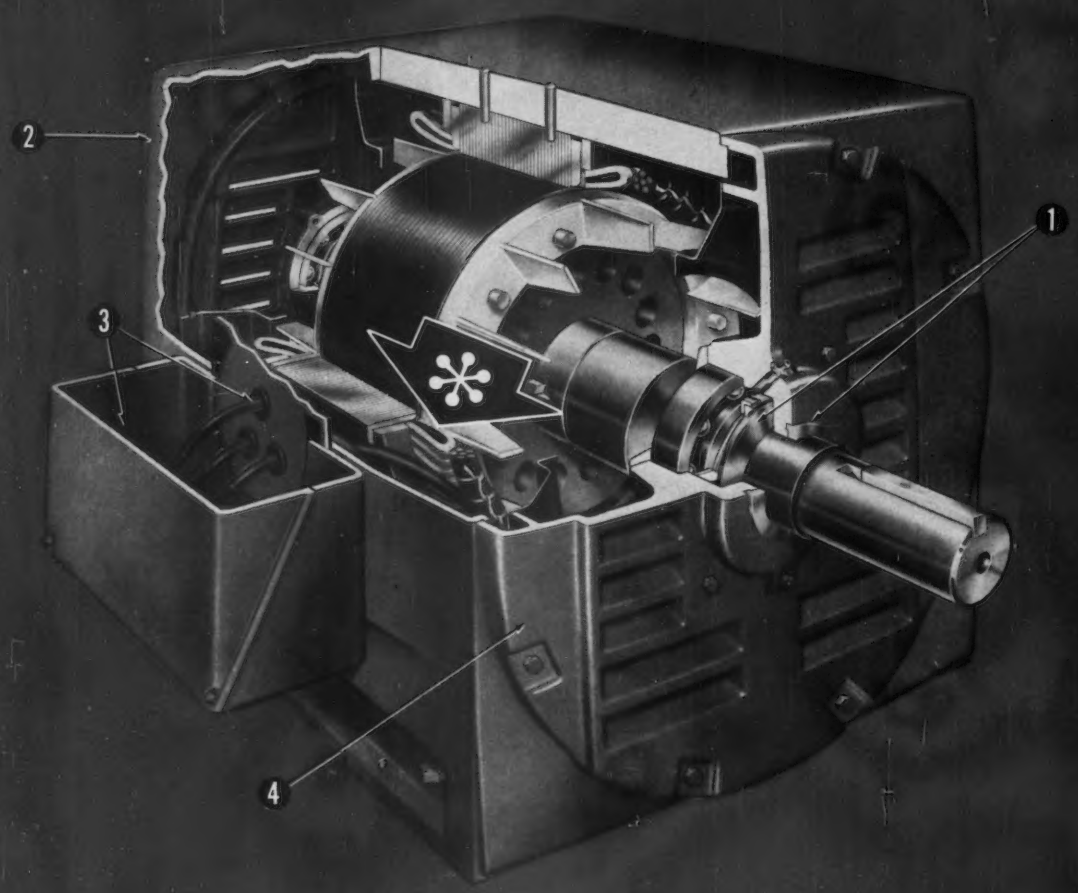

1 WATER RESISTANT BEARING SEALS guard bearings of 'CUSTOM 8000' motors against damage from moisture and abrasive dusts encountered in mining operations.

2 RUGGED CAST IRON FRAME is built to give maximum protection on toughest jobs—frames are factory tested to withstand shocks in the magnitude of 20G.

3 EXTRA LARGE CAST IRON CONDUIT BOX has gaskets at the split and between frame and box to seal out dust and moisture. Leads enter box through rubber grommets which seal out ambient air.

4 NEW, FLAT, CAST IRON END SHIELDS are designed for durability, yet offer the lightweight, easy removal features which can cut hours and dollars from your maintenance schedules. Angled louvers assure both effective protection and the maximum ventilating efficiency demanded of mine and quarry motors.

IN ADDITION TO THE SPECIAL FEATURES for mine and quarry applications mentioned above, **CUSTOM '8000'** motors offer these superior "standard" features: "positive purging" lubrication system with rotating slinger increases bearing life and prevents grease leakage along the shaft (new sleeve bearing design also available); pre-wound stator core assures uniform high performance; and, dynamically balanced, cast aluminum rotor windings and fan provide maximum reliability.

CUSTOM '8000' MOTORS are manufactured to the rigid quality specifications General Electric has adhered to for over 80 years. Today with the implementation of advanced design and manufacturing techniques, G.E. can accurately and economically *Customize* motors to your specific requirements through utilization of motor components engineered exclusively for mine and quarry applications.

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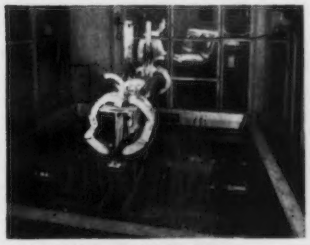
POLYSEAL * INSULATION SYSTEM LENGTHENS MOTOR LIFE

General Electric's new Polyseal supported silicone rubber insulation system is highly resistant to abrasion by airborne particles usually found in mines and quarries.

The Polyseal system assures superior mechanical, thermal, voltage and environmental endurance. This form-wound insulation is a vulcanized system "built up" from silicone rubber tape reinforced by glass and Dacron† fabric. Polyseal both retains its resilience and provides a positive seal against moisture and other mine and quarry contaminants.



POSITIVE MOISTURE PROTECTION is assured by "under water" production line tests. For example, 2300-volt, form-wound Polyseal coils are water soaked for one-half hour—then "hi-potted" at 8000-volts while still completely immersed—to prove the insulation system is absolutely sealed.

† *Registered Trade-mark DuPont Co.*

CALL YOUR GENERAL ELECTRIC APPARATUS SALES OFFICE

for full information on CUSTOM '8000' motors for mines and quarries, or write for Bulletins GEA-6865 and GEA-6889, to Section 884-12, General Electric Company, Schenectady 5, N. Y.

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GENERAL ELECTRIC

OME *(Continued)*

has granted another $13,320 to Lithium Corp. of America Inc. for beryl-columbium-tantalum exploration in Custer, S.D. This amount represents one-half of the total estimated cost of the operations.

The third contract, worth $17,530, goes to Cog Minerals Corp. for mercury exploration in Lake, Calif. Total estimated cost of the project is $35,060.

ALASKA

Admiralty Alaska Gold Mining Co. at Funter Bay is drifting on the 200 level towards the copper-nickel Mertie Lode. The drift, advanced to a total depth of more than 5,000 ft, is penetrating a broad zone of disseminated pyrite and pyrrhotite.

Alaska State Mines this summer completed 350 ft of tunnels through the ice of Texas Creek Glacier near Hyder, to find a deposit of electrum. Specimens from the deposit contained extremely high values.

The property at the Lost River tin mine, the only tin producer in the United States, was awarded to Lenhart J. Grothe by GSA on his high bid of $21,777.

ARIZONA

Banner Mining Co. has picked up added reserves of 4%-grade copper in drilling its Eisenhower group of claims at properties in the Mineral Hill district southwest of Tucson. The company deepened an existing but barren drill hole to find the new ore. Despite the apparent encouragement, a Banner spokesman said that the latest discovery could not be evaluated fully until completion of further drilling.

Colorado Fuel and Iron Corp. has announced successful conclusion of more than two years of negotiations with the White Mountain Apache tribe granting the company an exclusive prospecting permit and option to lease Apache Indian land in Arizona.

The permit covers 188 sq miles in the northwestern section of the Fort Apache Indian Reservation, and gives right to prospect for all minerals except oil and gas. This agreement is for two years, with the right to extend it for an additional two years if desired.

CALIFORNIA

Value of California's total mineral production dropped slightly in 1959 for the second straight year, according to an advance summary published by Division of Mineral Resources of the Bureau of Mines.

Mineral fuels, which represent 69% of California's total mineral production, led the decline, dropping from $1.1-billion in 1958 to $988-million in 1959.

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ROTATION WITHOUT IMPACT —efficient gear motor supplies rotation in either direction, even when drill is not impacting. Three rotational speeds.

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IMPACT AND ROTATION —use light percussion and rapid rotation for soft formations . . . or heavy impact and slow rotation for drilling hard rock.

UP TO 30% FASTER PENETRATION

New PR123 uses all hammer energy for percussion. There's no rotational drag on piston hammer. Results: faster hard-rock drilling than ever before. Depth of hole does not affect drilling speed.

SELECTIVE DRILLING

Now your driller can select the right combination of rotation speed, impact force, feed pressure and hole blowing for fastest penetration in any type of rock—can change drilling action as soon as the bit hits a new formation.

NO ROTATION PARTS IN CYLINDER

New PR123 has no rifle bar, ratchet ring, pawls, or other internal rotation parts that frequently cause trouble. Rotation is supplied by an efficient gear motor, and a torsion bar absorbs rotational shock between shank and motor.

POWER COUPLING AND UNCOUPLING

Independent power rotation is a time-saver. Rotation without impact permits power coupling of threaded rod without thread damage. Reverse rotation speeds uncoupling when coming out of the hole. Independent power rotation also helps free stuck steel.

Specifications: Piston diameter: 4½". Length: 38½". Weight, less mounting: 290 pounds.

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California *(Continued)*

Total production fell from $1.5-billion to $1.4-billion, the lowest figure since 1955.

Nonmetallic mineral production, however, is on the increase, reports the Bureau. Value of the 1959 output advanced to $400-million from the 1958 figure of $356-million, and accounted for 28% of total production. Leaders in this category were cement, sand and gravel.

Gravel left over from the discontinued placer gold operation at Oroville, Calif., will be more valuable than the gold previously mined. American Mining & Development Co. is putting the former gold operation back into business, as a gravel supplier to the contractors building the series of dams on the Feather River.

The Oroville properties will produce 2,000 tpd at first, but output will increase as the demand for gravel for the Feather River project increases. As a by-product operation, American Mining will wash the gravel once more to recover any gold remaining.

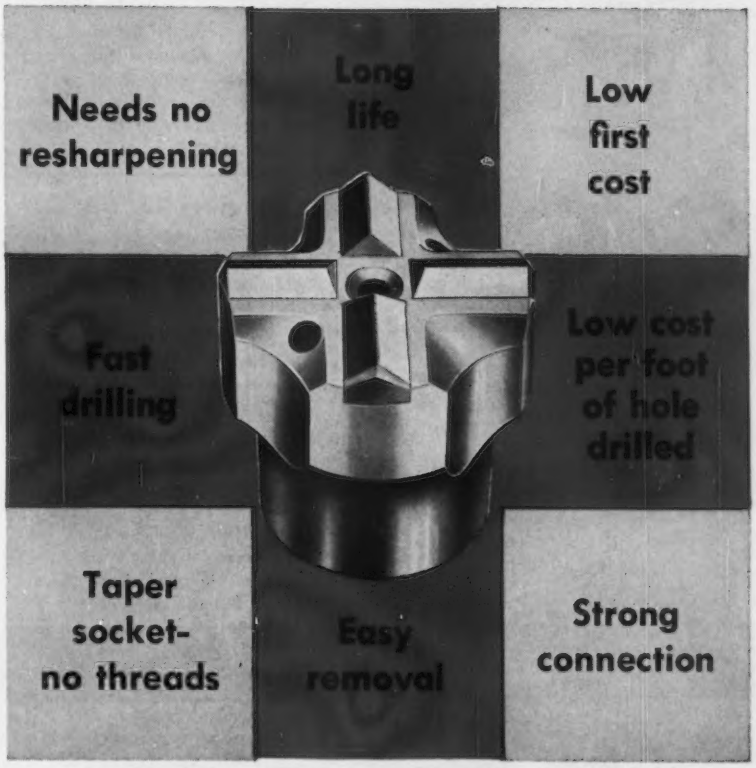
Underground development carried on for some time at the Royal Drift gravel mine near Magalia, Butte County, by the Royal Drift Mining Co. to open up a new section of the 3-mile long gold-bearing channel covering the property is nearing completion and active production is scheduled soon. Preliminary rehabilitation work

done included reopening of the 1,500-ft Best tunnel and the 1,240-ft Eagle tunnel in which less than 100 ft remain to be driven to contact the channel.

The mine is not new. It was discovered in 1879 by two prospectors, Best and Garland, and has been operated intermittently since then. Past gold production from the upper 400 ft of the property is estimated at $800,000. The cemented gravel in the buried stream breaks easily, and as a consequence only light blasting is required. Gold occurring therein is coarse.

Equipment available at the mine consists of a large compressor, pumps, drills,

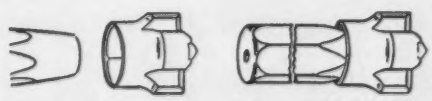
A PATTERN FOR BETTER DRILLING



LIDDICOAT TEE CEE BIT

The exclusive, shallow, long-life inserts of the TEE CEE BIT need no resharpening. LIDDICOAT design precludes the reverse taper dullness common to conventional bits and gives TEE CEE BITS a fast and effective drilling life lasting far beyond the point where conventional bits must be withdrawn from service for sharpening.

The bodies for LIDDICOAT Bits are forged from nickel alloy steel. The tremendous pressure which extrudes the desired shape retains the important grain of the steel . . . flow lines being compressed rather than cut across as is usual in forgings of this type. The compression of the material and retention of the unbroken flow lines give LIDDICOAT Bits unusually strong structure.



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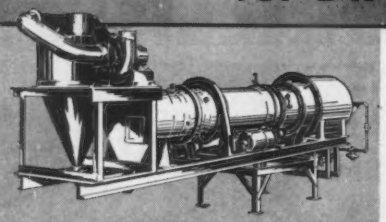
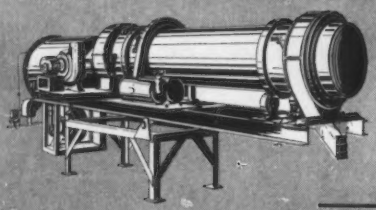


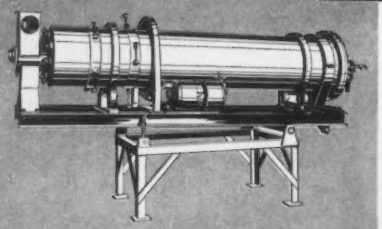
SINGLE-SHELL DRYER

Single-shell, direct gas fired rotary dryer. Arranged for either parallel or counter-flow operation. Mounted on structural steel base. Has removable "knockers." Bulletin AH-471.



DOUBLE-SHELL DRYER

Double-shell, indirect-heat, gas-fired dryer for drying without contamination. Volatiles removed with only limited dilution. Shell rotation speed and shell slope easily changed. Bulletin AH-472.



STEAM TUBE DRYER

Steam-tube indirect heat dryer. Can be connected to any available steam supply or furnished with a 3-HP steam generator. Available in stainless steel or other corrosion-resistant materials. Easily moved from place to place. Bulletin AH-473.

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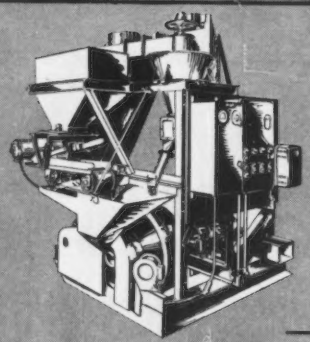
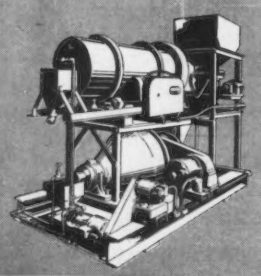


DRY GRINDING UNIT

Make power connections only and the Hardinge Dry Grinding Unit is ready to perform. Self-contained and portable, 7′ 8″ high. Complete with Constant-Weight Feeder, Conical Mill, "Gyrotor" Classifier, dust collector, product collector and "Electric Ear" grinding control. Bulletin AH-448.



WET GRINDING UNIT

Power and water connections only are needed to put the Hardinge wet grinding unit into operation. Self-contained and portable, 6½′ high. Includes Conical Mill, Counter-Current Classifier, launders, feeder, pump and "Electric Ear" grinding control. Bulletin AH-448-1.

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BIRMINGHAM

California *(Continued)*

mechanical loader, air-operated locomotive, mine cars, lighting plant for camp, a rotary trommel for washing mined gravel and a riffled sluice for recovery of gold. Operations are directed by J. W. Turner, president-manager.

Kern County Land Corp., San Francisco, has won federal court approval for purchase of two borax mining claims, totalling 39 acres, in California's Death Valley from U.S. Borax. Geologist reports indicate approximately 200,000 tons of borates in the claims.

KCL will pay a total of $100,000 for the claims on the basis of $20,000 down and the remainder on a royalty basis at the rate of $1 per ton. U.S. Borax earlier had termed the figure, set 15 years ago in a Federal antitrust decree, as punitive. The 1945 decree ordered U.S. Borax to sell the claims in question, but it was not until this year that a suitable purchaser materialized.

Kern County Land has extensive borate reserves—totalling in the millions of tons—but has not entered the boron market as yet. KCL has been making preliminary plans, however, to develop its claims, which are heavy in calcium borates, in the near future. A market for boric acid might be the first target, according to a KCL spokesman in San Francisco.

COLORADO

A shaft headframe and hoisting plant will be constructed and installed in the Storke Level yard of American Metal Climax Inc. this fall.

The installation is preparatory to sinking a vertical service shaft to transport personnel, mining and crushing equipment and supplies from the yard to the new production level under development 300 ft beneath the Storke Level.

In addition, a personnel tunnel was driven from the present mine dry building to the area of the shaft collar. When complete, the tunnel will provide an all-weather access to the shaft collar for miners. Actual sinking operations at the shaft will not begin until next year.

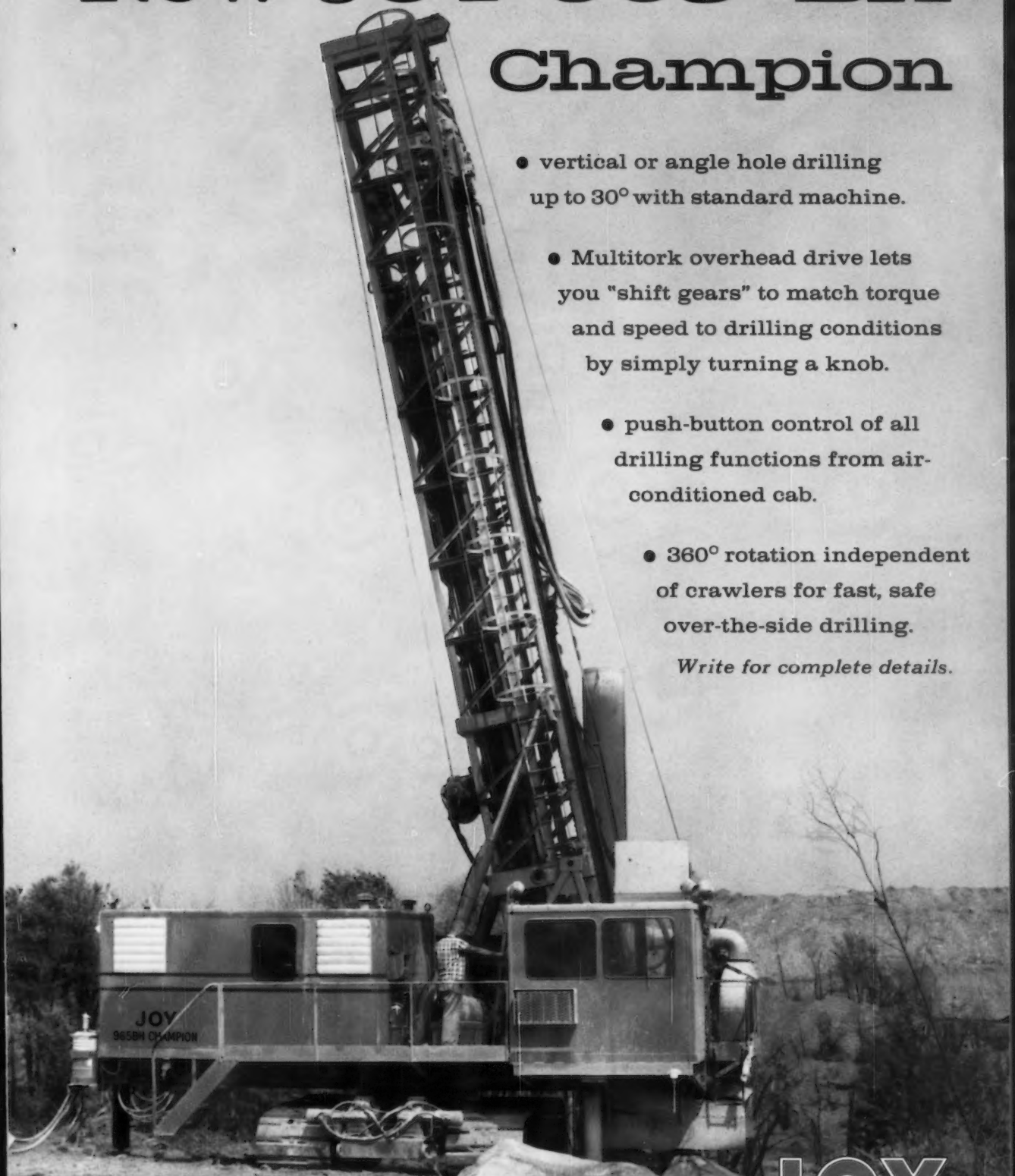
Morrison-Knudsen Co. Inc. recently began surface-mining and hauling iron ore from virgin deposits located some 10 miles, as the crow flies, from its coal mine operations between Carbondale and Gunnison.

The iron deposit protrudes, without overburden, at the 11,500-ft level of Taylor Peak. Ore extraction will be confined to a three-month period each year because of the very heavy snowfall in the area.

Operations have been suspended on development work at the Big Five Tunnel and the Lucania Tunnel in Clear Creek County, near Idaho Springs.

More than 20 miners had been working on drilling a 1,700-ft ventilation shaft, laterals to known orebodies, and other work designed to bring the long-idle properties back into production.

New JOY 965-BH Champion



- vertical or angle hole drilling up to 30° with standard machine.
- Multitork overhead drive lets you "shift gears" to match torque and speed to drilling conditions by simply turning a knob.
- push-button control of all drilling functions from air-conditioned cab.
- 360° rotation independent of crawlers for fast, safe over-the-side drilling.

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This big 7-yd. VICON dragline removes 5,500 yards of shale and sandrock overburden every 10-hr. shift. Making 40-ft. deep cuts, the 4500 VICON is equipped with a 100-ft. boom.

The Manitowoc Model 4500 VICON represents the most outstanding advancement of excavator design in decades. Here is a 6 yard shovel or 7 yard dragline incorporating new, tested design principles to give you more yardage in less time than any other mechanical or electrically driven shovel-drag in this size range. Thoroughly proved on the job for over three years, VICON design has increased yardage 25% or better, substantially reduced maintenance costs, and piled up more profits for owners. Some exclusive VICON features are:

INTEGRATED CONTROLS that serve both as clutch operating levers and as engine throttles, providing variable speed control over each function. Clutches, being responsive to lower range of control pressures, are engaged before engines are accelerated. Slippage and overheated friction surfaces are eliminated, lengthening clutch life appreciably.

HOIST AND DRAG DRUMS ARE INTERLOCKED to automatically synchronize their operation. Cycle time is faster and output is greater because full horsepower is always available for hoist—the operator doesn't "soak" it up with the drag brakes. Operating costs are noticeably less because brake use is cut by 50% and lining wear is drastically reduced. Another advantage of the VICON interlocked drum arrangement is that the operator can "power lower" or free-cast the bucket.

DUAL INDEPENDENT ENGINE POWER with one engine powering the main drums, and the second all other functions. Here are all the advantages of electric or conventional diesel engine mechanical drive without the disadvantages of each. You get the performance characteristics of electric drive — smoother power flow, variable independent speed control, simultaneous operation of dig, hoist, swing, and propel functions—without sacrificing mobility, without incurring the headaches and special maintenance problems of electric drive, without needing a separate power source at every job site. You get the simplicity of mechanical drive without losing valuable production time because of engine "lug down", without needing to jam clutches into engagement at high and harmful engine speeds, without the limitations of operating speeds that are inherent in conventional diesel engine drive.

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(A subsidiary of The Manitowoc Company, Inc.)

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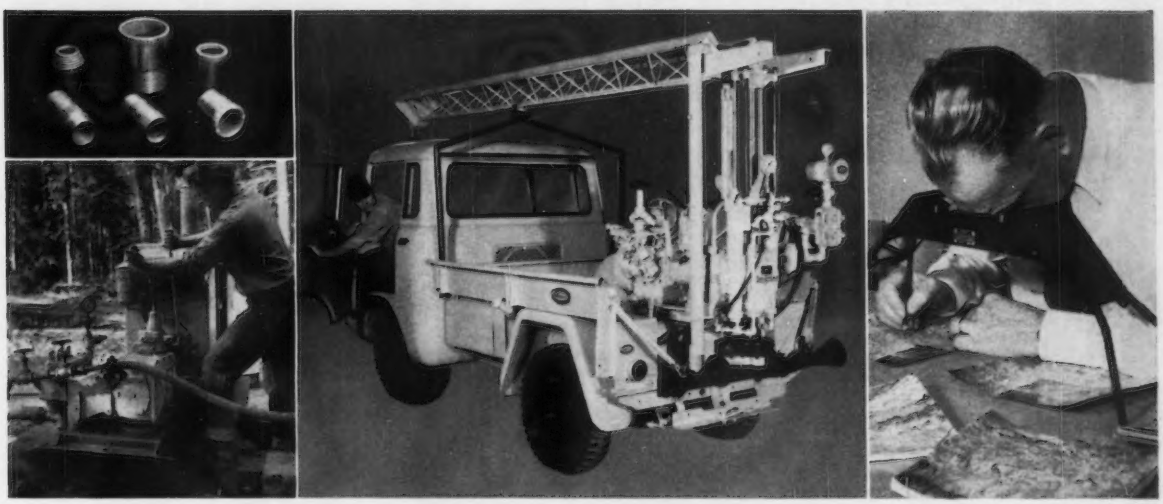

Adv. No. 152

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IDAHO

Dr. Rolland R. Reid, Idaho Bureau of Mines & Geology, says in a recently published "open file report" on the Sawtooth Mt. beryllium find that "none of the occurrences found to date appear to be of commercial value. However, because only very scanty reconnaissance work was done, further explorations appear warranted."

Unlike previous beryllium discoveries at Mt. Washington and Topaz Mt., ore in this area is "disseminated aquamarine beryl" in granite. E. F. Cook, director of the state Bureau of Mines, said an extensive program of mapping and some trenching are planned for 1961 in the Sawtooth region.

A two-foot high grade silver-lead-zinc ore showing has marked the start of explorations on properties of Keystone Mining Co. in Utah's Park City district. The property is being developed by United Park City Mines Co. in a joint venture with Keystone and with support of a loan from the Office of Minerals Exploration.

UPC announced that the showing encountered in the Janey formation off the 900-ft level was "very encouraging," although of limited commercial interest. The Janey zone will be followed toward confluence with the Crescent Fissure in hopes metal values strengthen.

Net operating income of Sunshine Mining Co. for first half of 1960 was $361,616, compared with $342,099 for the same period of 1959, according to company president Robert M. Hardy. Tonnage milled during the first six months of 1960 was 113,689 tons, 1,815 tons less than in the corresponding period in 1959.

The Bunker Hill Co. had a loss of $52,397 for the second quarter of 1960. Emmett G. Solomon, chief executive officer, attributed the loss to the generally soft market for lead, a sharp drop in domestic demand for Special High Grade zinc, and suspension of work at the company's Kellogg operations because of the Mine-Mill strike.

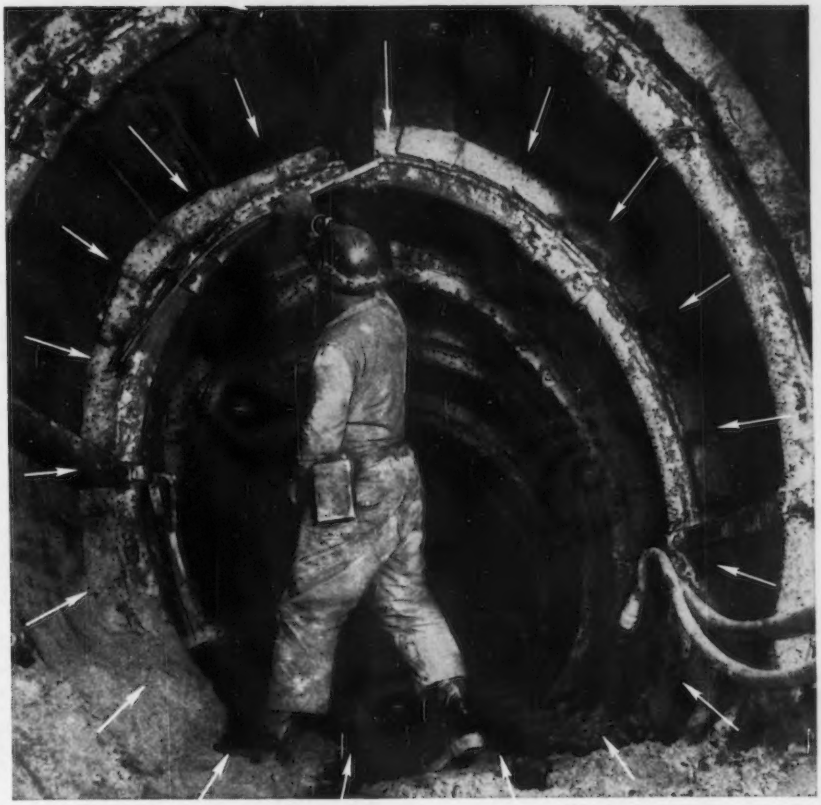
Donald E. Majer, president of Conjecture Mines Inc., reports that crews are installing a new hoist motor and control, preparatory to sinking operations on the Pend Oreille Lake property of the company. The new equipment will permit sinking an additional 1,000 ft.

Zontelli Bros. of Ironton, Minn., has continued its diamond drill exploration program near Potlatch, where it is investigating a magnetite iron ore prospect optioned from the R. M. Adams Co.

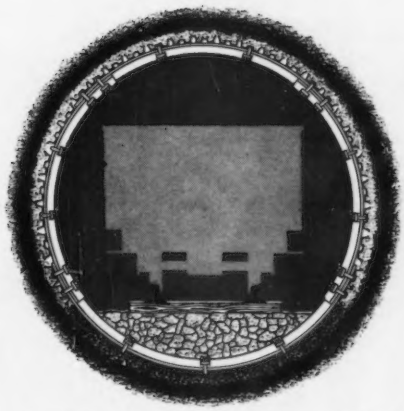
Machinery Center Inc., Salt Lake City, says that it does not plan to reopen the cobalt mines at Cobalt. However, the properties may be reopened next spring if market conditions improve.

Ray LaRocco, property manager for the firm, said the principal reason for keeping the mines closed was the inability of the company to obtain release

WHEN PRESSURES SQUEEZE FROM ALL DIRECTIONS



...install Bethlehem Yieldable Rings



Lagging should completely surround the Yieldable Ring set. Poles, planks, steel ties make good lagging.

If your mine opening has a heaving bottom, or is subject to squeezing pressures from all directions, the Bethlehem Yieldable Ring offers the best means of control. The Ring is a four-piece yieldable set with four joints instead of the usual two found on the Yieldable Arch.

Essentially, the Yieldable Ring is similar to the Yieldable Arch. It is made of the same nestable U-shaped sections, works on the same sliding-joint principle, and is available for the same range of mine openings—from 6 to 20 ft in diameter.

Installation of the Ring set differs from the Arch in that the two joints at the bottom of the ring should be tightened to about 150-ft-lb, instead of the 180-ft-lb torque normally applied. This is due to the fact that the bottom two joints usually will lie in muck, which adds measurably to the friction in the joint.

One more important point: with the Yieldable Ring, as with the Yieldable Arch, lagging and packing are necessary to fill the voids between steel and rock. Lagging should *completely surround* the Yieldable Ring, as shown in the sketch.

Bethlehem engineers will be glad to visit your workings to determine how the Yieldable Ring or Arch might improve your roof control. For action, just get in touch with the nearest Bethlehem office.

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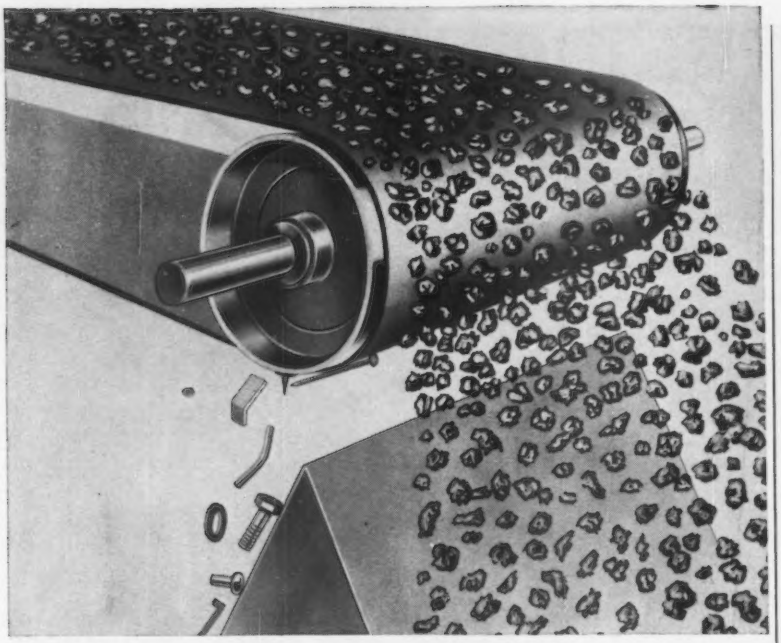

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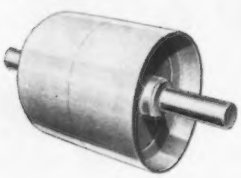

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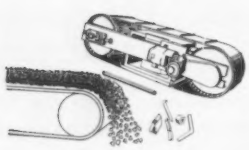
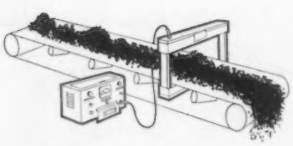
Ceramic Permanent-Type Pulleys—Dings new ceramic radial-pole Perma Pulleys, made of Ceramox V, provide high magnetic strength across the entire belt width and assure greatest removal efficiency at high operating speeds. Automatic unit requires no wiring, no power, no maintenance. Stainless steel surface for all weather service.

Electromagnetic Pulleys—These powerful, air-cooled pulleys give a dense, uniform magnetic field which is effective on burden depths over 3 inches. Low operating cost, long life, and maximum range characterize this workhorse of the Dings line.



SELF-CLEANING RECTANGULAR MAGNETS

Here's a powerful suspended magnet for pulling iron from the fastest belts and through the deepest burdens. Discharge is automatic and constant, as self-cleaning unit is equipped with an endless belt which sweeps iron from the magnet face. In-line models, installed parallel to burden travel, and across-belt models available.



TRAMP IRON DETECTOR

With a Dings Universal Series Detector, the moment tramp iron enters the search coil area, an alarm is set off or the conveyor is automatically stopped. It's the lowest cost tramp iron protection ever offered, especially valuable where excessive belt speeds or deep burdens may make the use of magnetic separators impractical. Dings Universal Series Detectors are also easily installed on spouts, chutes, troughs or slides.

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All Dings products are offered in a wide range of sizes to meet your exact requirements for protection against tramp iron. Write for complete details of the units shown here, and ask for information about the many other types of magnetic equipment in the complete Dings line.

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Idaho (*Continued*)

of mining claims that are necessary for successful operation of the property.

Development work has been started by Lexington Silver-Lead Mines Inc., Spokane, at the Hibernia property near Mullan. The company is reopening the portal of a 1,000-ft tunnel driven in the 1930's. Plans call for exploratory diamond drilling or sinking of a winze on a lead-silver showing that had been intersected by the tunnel. The property, located near the Lucky Friday mine, is owned by Lexington, Alpine Mining Co., and Hunt Silver-Lead Mining Co.

MICHIGAN

A study aimed at using waste sulphite liquor from the manufacture of pulp is under way at Michigan College of Mining & Technology, under the sponsorship of the Sulphite Pulp Manufacturers' Research League.

If successful, the project could have a two-way benefit. Waste sulphite liquor is dumped into streams and rivers normally, but utilization of the material would aid stream conservation and help the iron ore industry as well.

The Copper Range Co. has awarded a contract to the Boland Development Co. Ltd. to sink a shaft on its property two miles southwest of the White Pine mine. The shaft is scheduled for 1961.

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THERE'S NO EASIER DRILL TO RUN THAN A REICHdrill!

This smooth operating, all-hydraulic rotary rig is helping REICHdrillers set higher footage records

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Hydraulic drive to drill stem eliminates power loss . . . transmission troubles . . . kelly and rotary table.

Vari-speed Hydraulic Drill Control gives the operator the right combination of rotary speed and feed pressure for every formation . . . leveling jacks, mast raising cylinder and barrel loader are hydraulic too!

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Kleenslot preparation screens are designed for vibrators or stationary applications for dewatering, screening, washing, extracting, filtering or sizing applications.

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Michigan *(Continued)*

Hanna Mining Co. has asked the Michigan State Water Resources Commission for permission to divert additional water from the Sturgeon River, for use in processing low-grade iron ore at its Groveland Mine. Reason for the request was an expansion program at the mine.

MINNESOTA

An expansion program that will increase permanent employees by 800 to 900 has begun at Reserve Mining Co.'s Silver Bay plant. In addition to the $120-million required for the plant expansion, Reserve will spend $7½- to $12-million on new homes and shopping center facilities in the area.

To be completed by 1963, the modifications will increase plant capacity from 5½ million to 9 million tpy.

A conditional approval of an exchange of 4,239 acres of state-owned lands in St. Louis County for 4,524 acres owned by the Oliver Iron Mining Div. in Crow Wing, Cass, and St. Louis Counties was unanimously approved by Gov. Orville Freeman, state auditor Stafford King, and attorney general Walter F. Mondale.

The exchange was authorized on condition that U.S. Steel Corp. begin substantial construction of a commercial taconite plant within five yrs. Failure to fulfill this requirement will nullify the agreement.

The mid-August marine report of M. A. Hanna Co. states that, of the 231 U.S. bulk carriers on the Great Lakes, 72 are laid up because of the decreased demand for steel, and therefore for iron ore. An estimated loss of about $1.8-million per month in wages accompanies the slow-down.

Nevada Mines Div. Plants Grasses to Control Dust

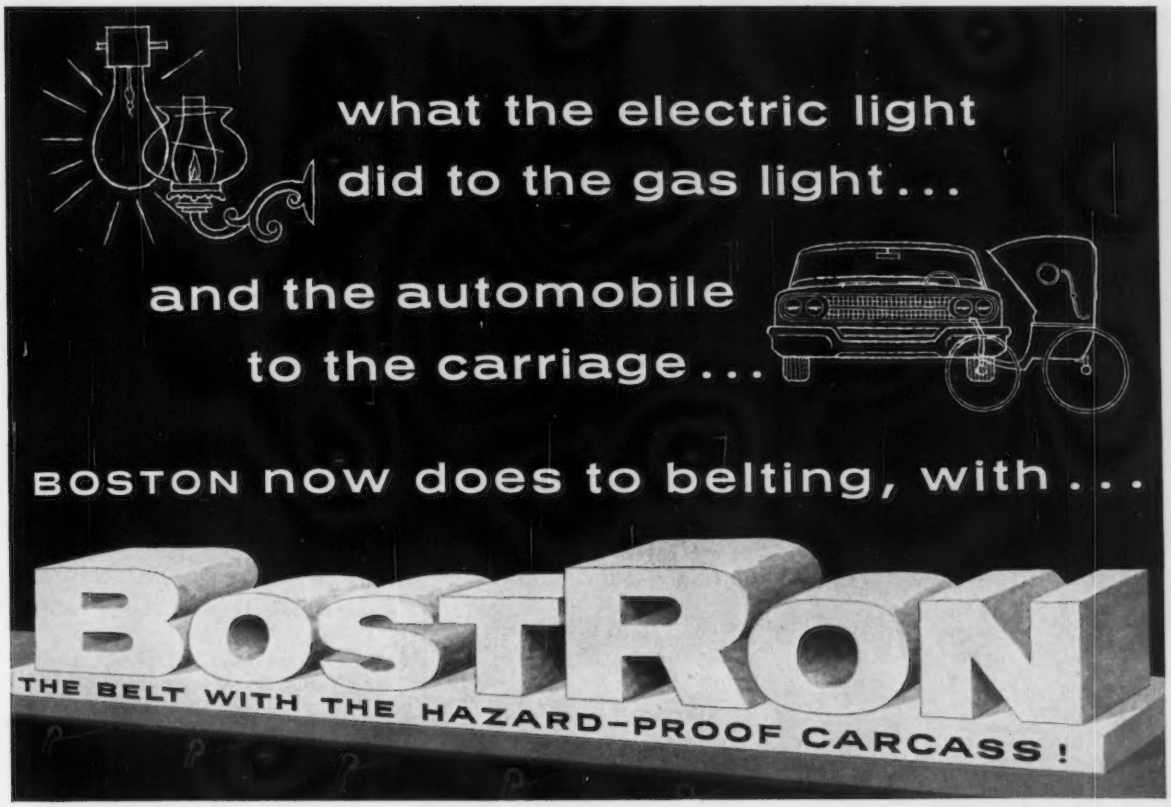
NEVADA MINES DIV. of Kennecott Copper Corp. tries to keep down dust storms from its tailings flats by planting a variety of grasses on its tailings.

At the start of the growing season, a portable sprinkling system waters the ground. The "pipeline on wheels" moves over a large area, and its several sprinkler heads fan water about over the ground. When the ground is moist, it is harrowed, to break up the surface and make it easier for seeds to take root.

A seed combination of rye grass, alfalfa, clover and wheat is sown; it is then fertilized and carefully watered. The combination of grasses provides a quick growth of some varieties.

MONTANA

A bill which drew only one negative vote in its travels to enactment by the 1959 state legislature failed to attract one steadfast friend when its validity was challenged before the Montana Supreme Court and delared unconstitutional.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BOSTRON plies are stronger than steel yet have all the advantages of fabric. New BOSTRON Belts combine a hazard-proof carcass with Balanced Belt Construction and make your investment in a superior Dulon Cover the most sensible and dollar-saving way to purchase belts today!

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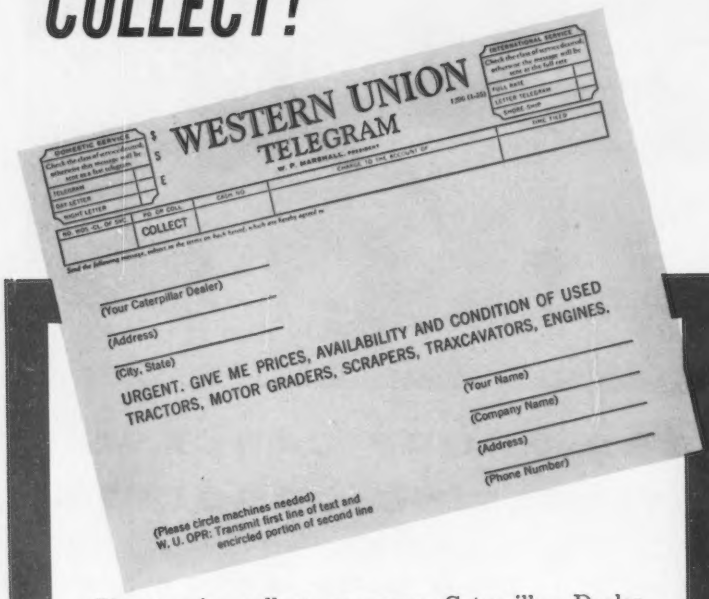

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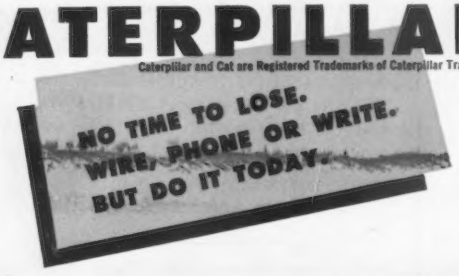


Montana (*Continued*)

The act, designed to average out valuation, for tax purposes, of proceeds from mining operations over a five year period, instead of assessing on the actual net of each year, was contested by Evan Roberts, operator of a flourspar mine, near Darby in Ravalli County.

In killing the law, the court held that the average is not the same as "annual net proceeds" provided by the constitution. One justice added that the legislature "was wholly without authority or power to substitute an average net proceeds tax for the annual net proceeds tax."

Spokane National Mines Inc., Spokane, has started milling ore at its Bannack property. The mill, operating on a one-shift basis at the rate of 75 tpd, is treating ore from the Bannack gold mine and from the nearby New Departure silver mine, where a flotation unit was added recently.

NEVADA

Nevada mines produced 322,893 oz of silver during the first half of 1960, an increase of 23,820 oz over the same period in 1959, according to USBM.

White Caps Gold Mining Co., which produces gold and mercury ores from the White Caps mine at Manhattan, and uranium ore from the Lowboy mine near Austin, has become Nevada's most diversified mining firm, by purchasing a beryllium property east of Lone Pine, Calif. The company expects to start immediate development of the new property.

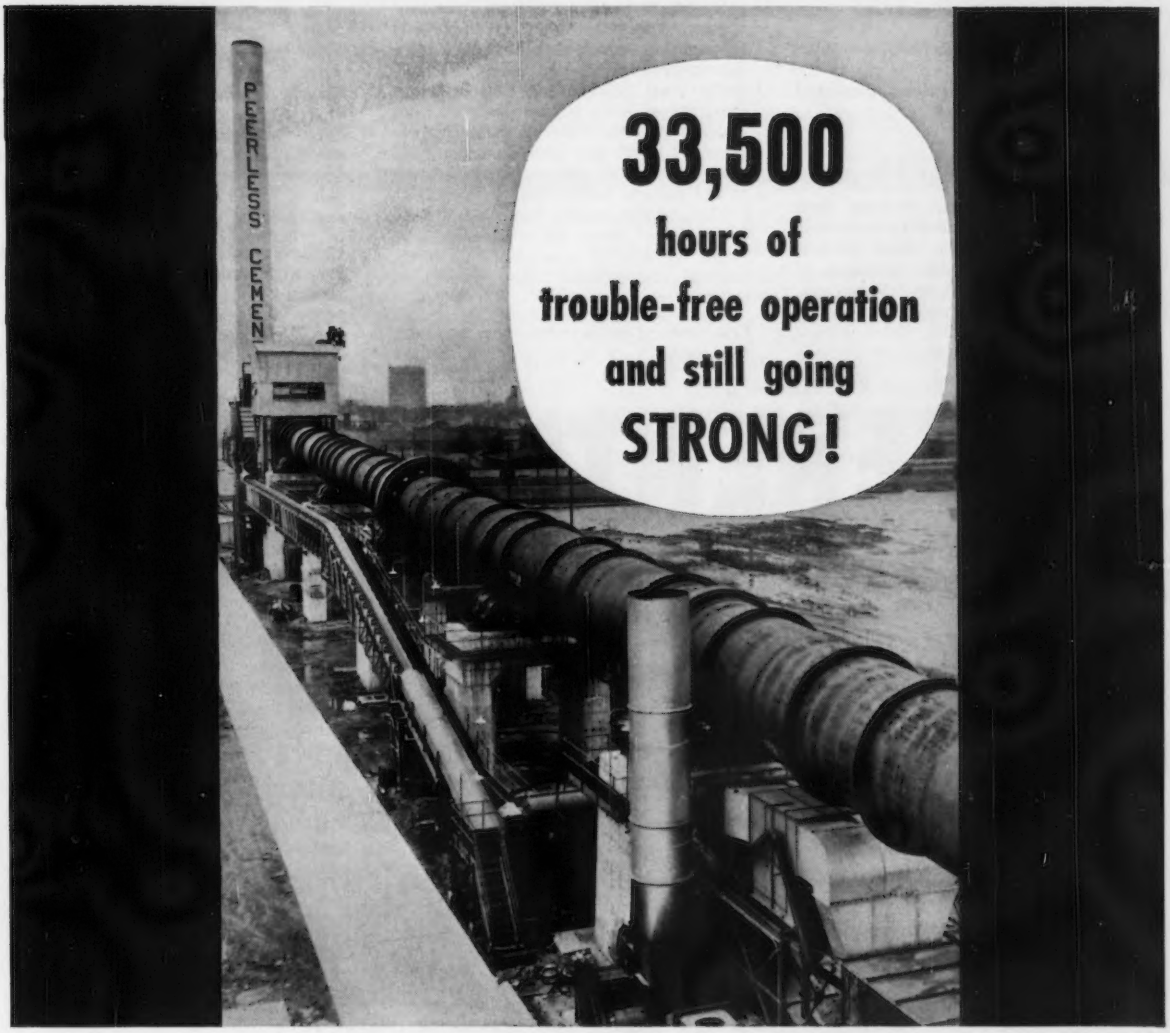
Goldfield Consolidated Mines has purchased 42% of the outstanding shares of Getchell Mine Inc., giving it operating control of the extensive Getchell property in Humboldt County. The sale included 289,000 shares from the Noble Getchell estate and 350,000 shares from the George Wingfield estate.

NEW MEXICO

A new safety record was set at Kennecott Copper Corp.'s Chino Mines Div. in August, when the mill extended its accident-free operation to 600 days. During this period an average of 224 employees put in more than a half-million man-hours without a lost-time injury.

Work on two shafts costing over $1-million is progressing rapidly at a new production site for Duval Sulphur and Potash Co. A 14-ft-dia hoisting shaft is below 300 ft, and a 9-ft-dia escape-way shaft is at a depth of 400 ft. Duval will spend another $1-million on surface installations at the site.

Yates Drilling Co. has begun work on a second recovery hole at the Project Gnome underground nuclear blast site, after completing the first hole for the program. Everett Burgett Drilling Co. of



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TKA-10

New Mexico *(Continued)*

Carlsbad, contractor on two test holes for the USGS, has set up its rig on the site of hole No. 1, and is ready to start drilling.

NORTH CAROLINA

Rep. Charles R. Jonas (R-NC), from the district of mica-producing Avery and Mitchell Counties, has asked Federal tariff experts to abandon any idea of further cuts in the tariff on foreign mica. According to Jonas, the duties are "already at such a low point that it is most difficult for domestic producers to compete with low-cost mica from overseas."

He told the Committee on Reciprocity Information, which gathers data for the Administration on the effect of proposed trade negotiations, that after the Government stops buying domestic mica under a strategic minerals stockpile program, "I don't see how domestic mica producers will compete with the imports at the present tariff rates."

The Administration has placed mica on a list of items on which the U.S. might make tariff concessions at forthcoming international trade bargaining sessions.

Experimental drilling operations are under way again in an effort to find a method of profitably mining phosphate in coastal North Carolina. State geologist Jasper Stuckey announced that experimental work in the Bayview area of Beaufort County has shown good first results.

A. L. Nash Jr., who heads the latest effort, is trying to force the phosphate to the surface with water channeled underground by pipes. The problem is getting it to the surface at a low enough cost to leave some profit.

C. R. Hayes, 70, who heads the recently formed Whitney Reduction Co., has announced that the company, which is preparing to reopen the Whitney mine shaft near Gold Hill, will build a $650,000 plant to make metallurgical products at the site.

Construction of the plant will begin next spring, and will employ from 150 to 175 technicians, according to Hayes. He reported that the company was interested in copper, lead, zinc, antimony, silver, arsenic, and germanium deposits at the mine, but that anticipated gold finds would be produced as by-products as well.

TENNESSEE

American Zinc Co. closed down its North Friends Station mine when all developed reserves were depleted. It had been in operation since 1952, and was the first mechanized mine in the East Tennessee zinc district.

Tennessee Valley Authority has announced it will begin mining phosphate within the next few months from the area west of Franklin. The material will be mined on lands owned by TVA and from land on which the Authority owns mineral rights.

UTAH

Kennecott Copper Corp. has extended a high grade silver-lead-zinc discovery in its Utah Tintic unit by 200 ft through drilling. Out of a 217-ft hole, the firm recovered 63 ft of ore. The ore runs 23.47% zinc; 14.% lead and 4.1 oz silver. This is estimated to be around $105 a ton, gross metal value.

This ore discovery represents a northerly extension (by 200 ft) of a similar zone with like assay 500 ft west of the Burgin shaft. The added ore is only 300 ft from properties of Tintic Standard Mining Co., which have been committed to the KCC-operated unit.

Twelve sections of land northwest of Milford in Beaver County were acquired by Anaconda Co. for copper prospecting. A multi-million-dollar long-term option to buy the properties was signed with operators in the San Francisco mining district and the nearby Rocky mining district.

Central Oil and Mining Corp. has purchased the Delta mine in Emery County from owners Maxwell Bentley and Ralph J. Hafen. Central also announced acquisition of 80% of the stock of

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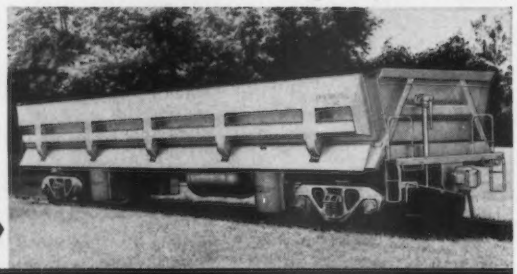
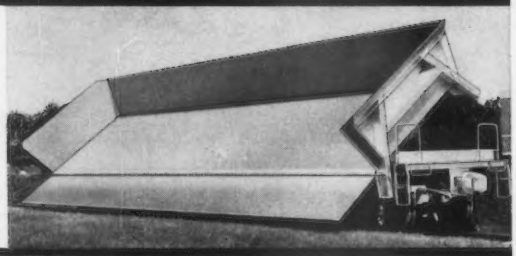
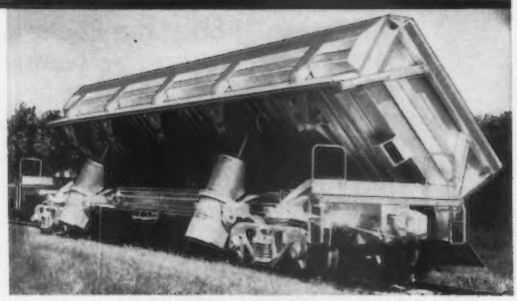


Smooth floor for clean dumping. Door and end construction designed to take the kind of beatings received in open pit mining.



Floor massively reinforced. Door operating mechanism under floor and protected from damage. Hardened and lubricated pins and bushings insure correct functioning and negligible wear.



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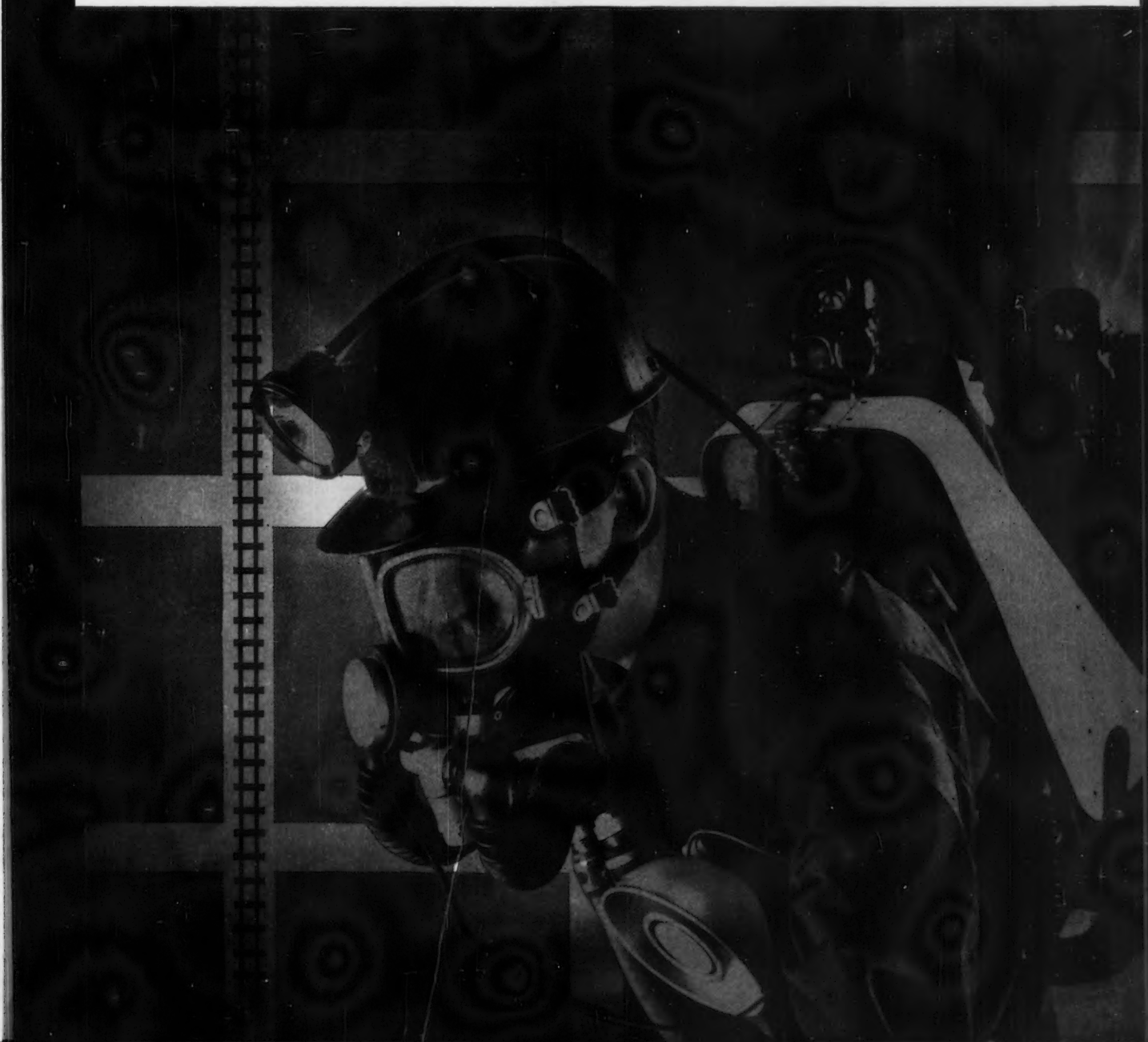

Utah *(Continued)*

Placeres del Noroeste, a Mexican gold mining firm controlled by two Californians, D. C. and J. R. Broadbent.

Decision to ship lower-grade uranium ores resulted in a decline in net profits for Standard Metals Co. during first half of 1960, reports company president William R. McCormick. Higher-grade uranium ores will be saved for shipment during the 1962-66 period, under a recent deal made with Texas-Zinc Minerals Corp.

McCormick also announced that Standard has some 2,700 ft of work ahead in tunnel-driving and rehabilitation work, before encountering the main lead-silver-zinc-gold fissure at its Sunnyside mine. The Micawber mine and mill at Crested Buttes has been operative, but results show these properties are marginal at today's prices, he said.

If some relief to the lead-zinc producer is not forthcoming, it is likely that Standard will shut down the Micawber operations permanently, according to the president. He added that his firm was not going to "subsidize" lead-zinc operations with uranium profits.

Keystone Mining Co. has encountered mineralization, in drilling out from older workings in the United Park City Mines Co. ground at Utah's Park City district. The two firms have a joint agreement, under which work backed by the Office of Minerals Exploration will be carried out in search for ore.

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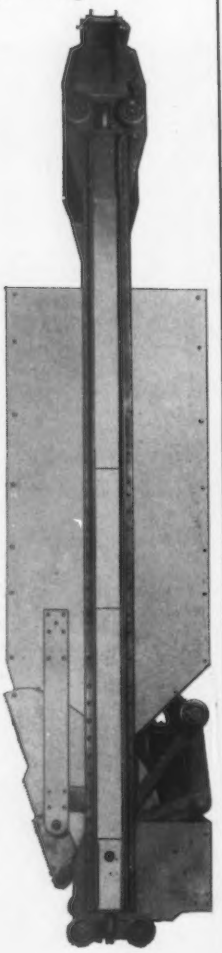

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WASHINGTON

Fire has destroyed the tungsten mill on the Spokane Indian reservation operated by Germania Consolidated Mines, Spokane. Officials said it would cost $100,000 to replace the recently modernized concentrator unit. The firm had suspended operations several years ago because imports had reduced prices, but it had been planning to resume operations.

WISCONSIN

Ashland Mining Co., the first firm to start large-scale taconite explorations in the Butternut area of northern Wisconsin, has not given up on its plans, but has shelved them for the time being, according to a company spokesman.

"When we started our studies in Wisconsin, there was a shortage of iron ore," the spokesman stated. "Now there is a surplus, so the prospects are not as desirable as they used to be."

IN CANADA

BRITISH COLUMBIA

Noranda Mines, Ltd. has signed a $1.15-million deal for a group of iron ore claims at Maggie Lake near Ucluelet, Vancouver Island. According to reports from the area, about 1-million tons of ore have been blocked out and reserves are expected to go well over the million mark.

Sheep Creek Mines Ltd. reported a profit of $397,600 for the fiscal year ended May 31, an increase of $175,046 from the previous year and the most successful in the company's history.

Three companies, Consolidated Mining & Smelting Co. Ltd., Empire Development Co. Ltd., and Coast Copper Co. Ltd., have signed an agreement to search for iron and copper ore on the west coast of Vancouver Island.

Under reciprocal agreements, Empire will explore for and mine iron ore on some Coast Copper claims in the Quatsino area, and Cominco will explore for and mine copper ore on some Quatsino copper-gold mine claims in the same area.

Trenching on the Columbia Explorations Ltd. claims near Yellowknife has ex-

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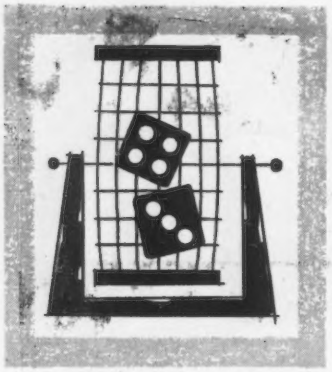

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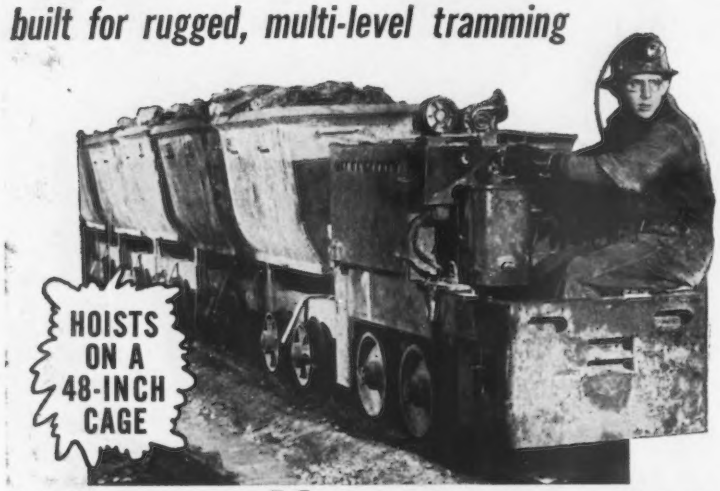

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B. C. *(Continued)*

posed visible beryl for more than 2,000 ft. Work in the area consisted of mapping, stripping, trenching and drilling and assay results are expected soon.

Canadian Institute of Mining and Metallurgy will hold its annual meeting in Vancouver October 16-19. R. Hendricks of Montreal will be moderator for a panel discussion on the future markets for western Canadian mineral production. Research and its relationship to western Canada is the subject to be aired under moderator Prof. L. G. R. Crouch of the University of B.C.

Canadian mining projects in progress or in the planning stage involve a capital expenditure of $1.5-billion, according to the 1960 CANADIAN MINES HANDBOOK.

Japanese trade sources indicated they could double or triple within a few years their present contracts now worth about $30-million for B.C. iron ore. The Japanese are investing heavily in B.C. copper and zinc properties and are eyeing establishment of iron and steel industries within the province.

ONTARIO

The Deloro smelter, near Marmora, is being closed after more than a half century of continuous operation. The plant, which treated cobalt and silver concentrates, is to be disposed of. Lack of silver concentrates is given as one of the reasons for the closure.

McIntyre Porcupine Mines has added substantially to the copper zone at its gold producing mine in the Porcupine area. Estimated tonnage now totals 7-million grading 1% copper. The zone is still open both vertically and along the line of strike. Fill-in drilling is being done to more fully outline tonnage and grade. Drilling has shown the copper lenses to extend from the 1,350 to the 3,500-ft levels, but the zone has been tapped on only the 1,625-ft level

Campbell Red Lake has finished shaft deepening to open seven new levels at its Red Lake area gold producing mine. Shaft bottom is at depth of 3,180 ft. Because both ore and waste passes have to be driven up from the 21 to the 14 level, it is expected that development of the new levels will not be undertaken for some time. However, as ore reserves above the 14 level are substantial, there is no rush to open the new levels.

Jones & Laughlin Steel Corp. has embarked on an accelerated program of additional diamond drilling on the Bost Twp, iron property, some seven miles southeast of Kirkland Lake. The program, which will be under the direction of the company's Canadian subsidiary, Jalore Mining Corp., is designed to fill in gaps left in previous drilling and to provide further details on the deposit. While the firm has not disclosed indicated ore reserves, it is unofficially reported that the property is being counted

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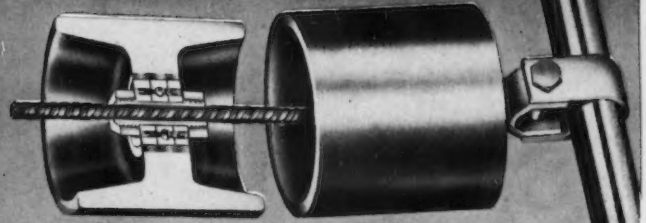

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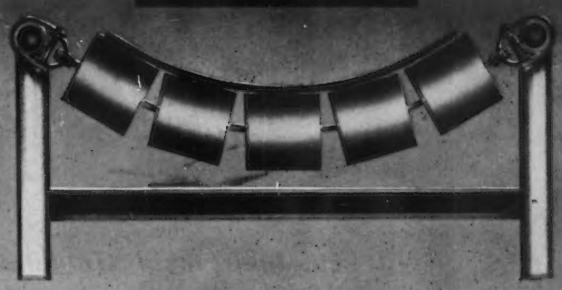

. . . is greater capacity and faster belt operation with minimum spillage. Since the belt lies in true arc with no creases or bends to cause wear, *belt life is substantially increased*. Because this unique McNally Pittsburg conveyor design is so simple, maintenance costs are lower; over-all erection time is reduced to a minimum as well.

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Ontario *(Continued)*

on to provide about 30 to 32 million tons of high grade iron concentrates, all from open pit operations.

International Nickel Co. of Canada and its wholly-owned subsidiaries marked up a substantial gain in both sales and profits in the first half of the current year Net sales amounted to $268.7-million, up from $212.4-million in the same period last year. Net profit was $43.9-million against $38.3-million.

Caland Ore Co., wholly-owned subsidiary of Inland Steel Co., has upped its production schedule for the current shipping season. Originally it was planned to ship some 750,000 tons of iron ore from the Steep Rock area operation. It is now estimated that shipments might total as high as 900,000 tons. Present production is being drawn from open pit and it is not anticipated that underground ore shipments will start until 1963. The production schedule calls for total shipments of 1-million tons next year and 2-million tons in 1962, after which the rate will be maintained for the next few years. It is planned to ship 3-million tons annually by 1969. The property is leased from Steep Rock Iron Mines on a royalty basis.

Falconbridge Nickel Mines is turning out record production from its nickel mines in the Sudbury area. Output in the first half year was at a rate of 64-million lb nickel annually. Previously it had been estimated that peak capacity was 65-million lb per year but it is now thought that this rate might be exceeded by an appreciable margin. The company is also making ready for shaft sinking at yet another mine, the Strathcona, in the Sudbury area. Production-size shaft is to be put down to 3,500 ft.

Production of zinc from the new plant of Sherbrooke Metallurgical Co. at Port Maitland is expected to start shortly. Shipments of zinc concentrates to the plant were started early in August at a rate of from 1 to 4 carloads daily. Concentrates are being supplied by Normetal Mining Corp. and East Sullivan Mines in northwestern Quebec, and New Calumet Mines on Calumet Island, Quebec.

Ryanor Mining Co., idle for several years, has come back to life under new management and with a new property. Under an agreement the company has obtained a lively nickel prospect on the north rim of Sudbury Basin adjoining ground held by International Nickel and Falconbridge Nickel. Ryanor has agreed under terms of property acquisition and purchase option to carry out geological and geophysical surveys plus a minimum of 2,000 ft of diamond drilling.

Profits of the four Elliot Lake area uranium producing mines merged to form Rio Algom Mines showed substantial increase in the first half of 1960 compared with the corresponding period last year. The greater portion of the increased earnings reflects the large reduction in mine operating costs. Net profit for the 1960 period amounted to $15.2-million, up from $8.6-million for the previous six months and from $6.3-million in the first half of 1959. Mine operating costs were slashed $9.6-million; gross revenue was up $631,000, while charges and other write-offs were $1.4-million more than those for the 1959 period.

QUEBEC

Campbell Chibougamau Mines is expanding the mill rate at its Chibougamau copper-gold mine from its present 2,700 up to 3,000 tpd by early fall. In the meantime, the Henderson mine is being groomed for large-scale operation. Shipping rate from this mine is now up to 300 tpd, will be boosted to 750 by year end and is expected to reach initial objective of 1,200 tpd in the first quarter of 1961.

New Hosco Mines has suspended diamond drilling on its Mattagami district property temporarily to study difficulties encountered in deep drilling. Negotiations are continuing in the meantime for major financing required for underground development and production. The A and B copper ore bodies have been estimated to contain 2,447,000 tons averaging 2.64% copper, including 1,633,-

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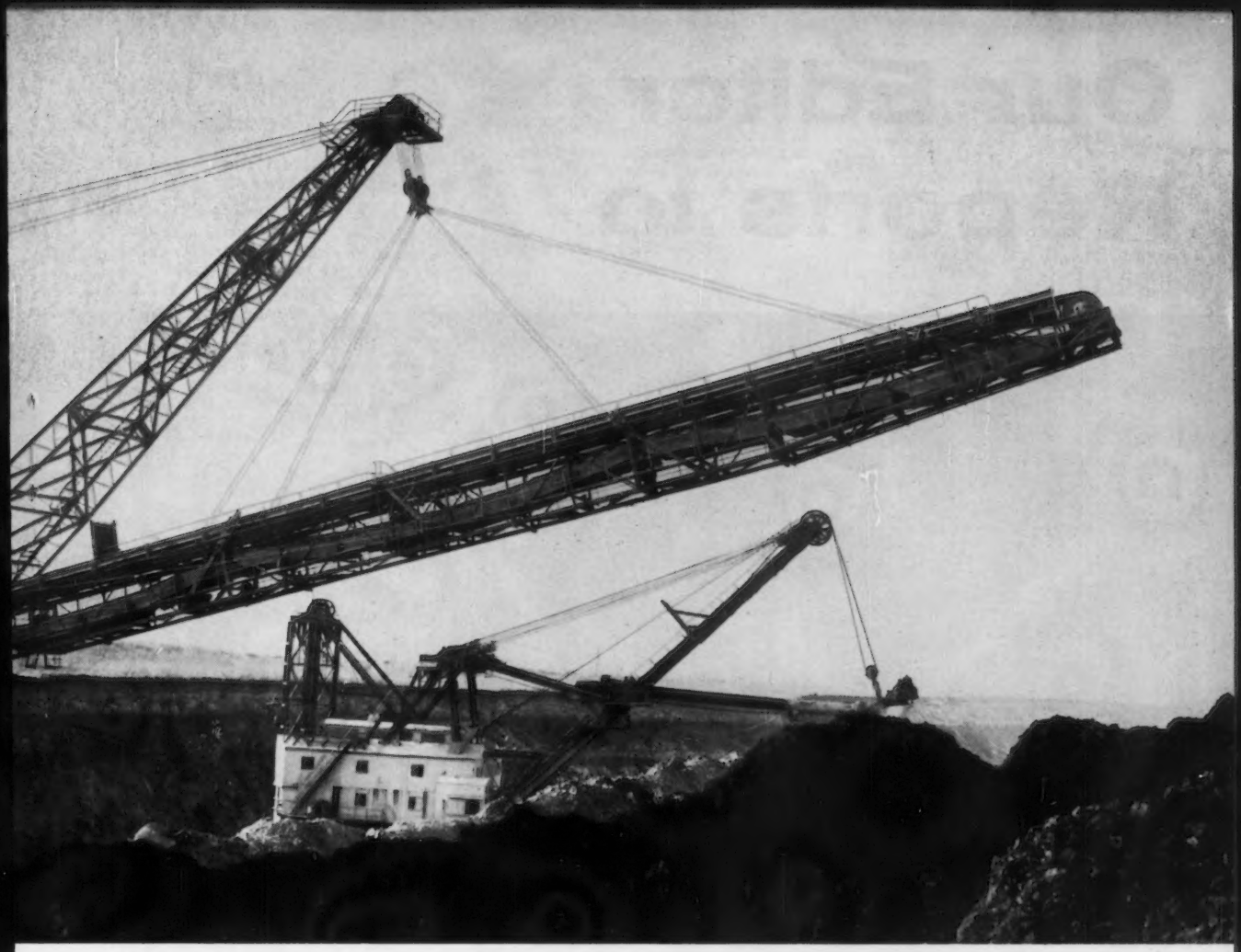

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Quebec *(Continued)*

000 tons calculated to average 3.01% copper. In addition, a separate zinc deposit has been calculated to contain 958,000 tons averaging 7.96% zinc.

Quebec Cartier Mining Co., U.S. Steel Corp. subsidiary, is in the last stage of the construction program at its huge iron mining enterprise on the north shore of the St. Lawrence River. First production of high grade iron concentrates is expected to be under way this fall with first shipments scheduled for early 1961. The project, rated as the largest single mining enterprise ever undertaken in Canada, is unofficially estimated to represent an expenditure of almost $300-million. It includes preparation of an open pit mine, construction of a mill, railway, power plant, two towns and port facilities. The large concentrator is designed to handle 20-million tpy with output of 8-million tons of high grade concentrates.

NEW BRUNSWICK

Heath Steele Mines has reopened its base metal property located some 34 miles west of Newcastle. Preparations are being made to put out a long drive in the B or eastern ore zone on the second level following unwatering of the shaft. Diamond drilling is then to be carried out from the drive to outline the ore. The program is expected to last until next spring, at which time consideration may be given to resuming milling.

IN LATIN AMERICA

GUATEMALA

Empire Industries Inc. of Salt Lake City has opened a mine in north central Guatemala to tap deposits of antimony. Located at Ixtahuacan, near the province of Peten, the $2-million operation has produced several test shipments that have been delivered to the United States.

CHILE

The Chagres copper smelter, which was shut down in 1945, is operating again following reconditioning. The smelter will handle concentrates from El Cobre mill which treats 1,200 tpd and Disputada mill with 750 tpd. These concentrates were formerly smelted at the Tacoma smelter.

The construction firm of Momberg and Thorsen has finished building a seven mile long belt conveyor for Compañia Minera Santa Fe to transport ore between the iron mine at Carmen and a siding at the railroad from Chanaral to Pueblo Hundido. This conveyor is the largest in Chile.

Foram Chilena is building a 150 tpd leaching plant to treat the oxidized ore from the Mantos de la Luna mine located south of the nitrate port of Tocopilla. The ore will be shipped to the mill by a two mile aerial ropeway.

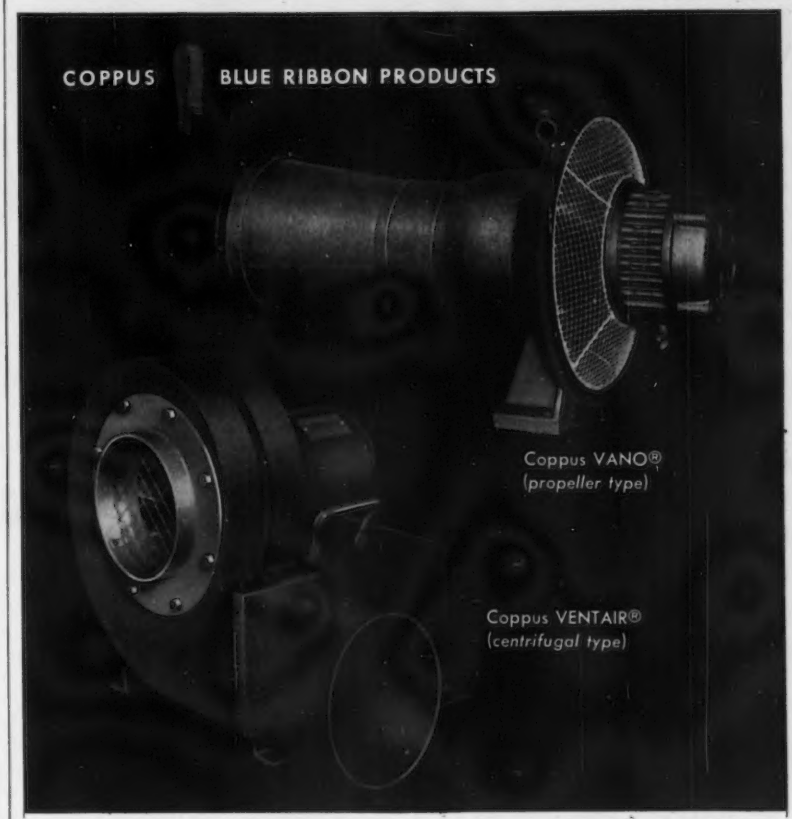
VENEZUELA

Venezuela has rejected a proposal to process some of its iron ore in a projected new plant in neighboring Trinidad. The Minister of Mines & Hydrocarbons announced that he had informed Venezuelan iron mining companies of official policy against exporting iron ore for reduction at the nearby project.

The minister said the government "is not interested in increasing iron ore exports much above present levels, because the country has complementary resources which make it convenient to reduce the ore here."

The country is planning development of an industrial complex of its own in the Guayana region, and exporting of iron in processed form.

Venezuela has revoked the nickel mining concessions held by a subsidiary of



GET 30% TO 100% MORE AIR

Coppus Blowers for mine ventilation include the centrifugal VENTAIR for long pipe lines and the propeller-type VANO for shorter lines. For a given power consumption both deliver from 30% to 100% more air than an ordinary fan.

Serving as blowers or exhausters they are driven either by electric motor or compressed air, with capacities up to 60,000 CFM. Like all Coppus Products, these blowers carry the same "Blue Ribbon" assurance of quality and dependable performance.

Representatives located in all mining areas. Other Coppus "Blue Ribbon" products: Steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also *Thomas' Register*. Coppus Engineering Corporation, Worcester 10, Mass.

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290 Park Avenue, Worcester 10, Mass.
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says—DUNDEE SAND & GRAVEL CO. of Dundee, Ill.

"We have cut our maintenance to a minimum with LUBRIPLATE lubricants. For instance, not a single wheel bearing replacement since using LUBRIPLATE No. 70. We are more than pleased with LUBRIPLATE Nos. 90 & 140 gear oils and LUBRIPLATE Nos. 630AA & 630-2 for chassis and general lubrication. We heartily recommend LUBRIPLATE lubricants to all quarry and fleet operators".

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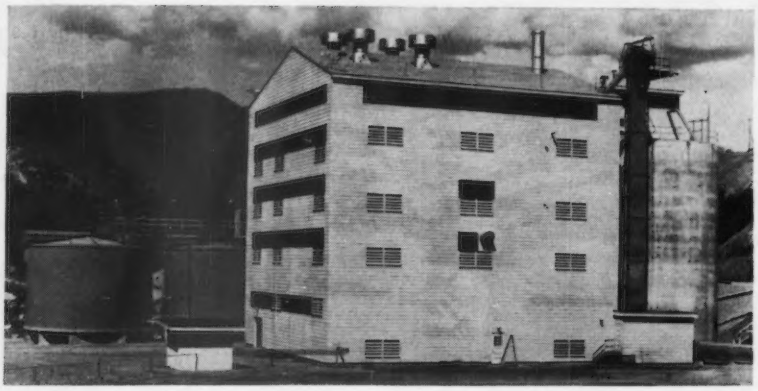

Bunker Hill Acid Plant Is Dedicated

THE NEW $2-MILLION Bunker Hill Co. acid plant at Kellogg, Idaho, will be ready to go into operation as soon as the current strike against the company is settled. Started in the fall of 1959, the project was completed in June and officially unveiled in September.

Operation of the plant will mark Bunker Hill's entry into the phosphoric acid field. The basic ingredient, sulphuric acid, is supplied in quantity from the firm's zinc plant operation. Phosphate rock, sulphuric acid's chief companion ingredient in the manufacturing process, will come from San Francisco Chemical Co.'s mining and processing facilities near Montpelier, Idaho, about 600 miles from the Kellogg operation.

The new plant will have a starting capacity of 130 tpd, aimed for use in the manufacture of fertilizers. Acid produced will not be in a finished form, the plant operators say, but must be processed further by the consumer.

Bumstead-Woolford of Seattle were the general contractors, and Dorr-Oliver Inc. of Stamford, Conn., did the design engineering work.

Venezuela *(Continued)*

International Nickel Co. of Canada, alleging failure to establish commercial exploitation under terms of the law. The six concessions, acquired in 1946 and 1952, were held by Meridional de Minas, S.A., and covered 7,410 acres.

PERU

South American Placers Inc. is carrying out exploration work on placer ground along the upper Inambari River and tributaries in southeastern Peru. The company has taken an option on property owned by Sixto Gutierrez, an operator of various mines in southern Peru.

Eduardo Busso is starting shipments of lead ores from a 14,000-hectare concession which he controls in the hill country surrounding San Ramon, Peru. The ores reportedly run 50% lead and 8 oz of silver.

In the adjoining area, Hochschild & Co. have recently acquired a 17,000-hectare concession, and are now operating the San Vincente mine with ores reportedly running 45% zinc and 20% lead.

MEXICO

Mexico's President, Adolfo Lopez Mateos, announced in the annual state of the nation speech that the government is

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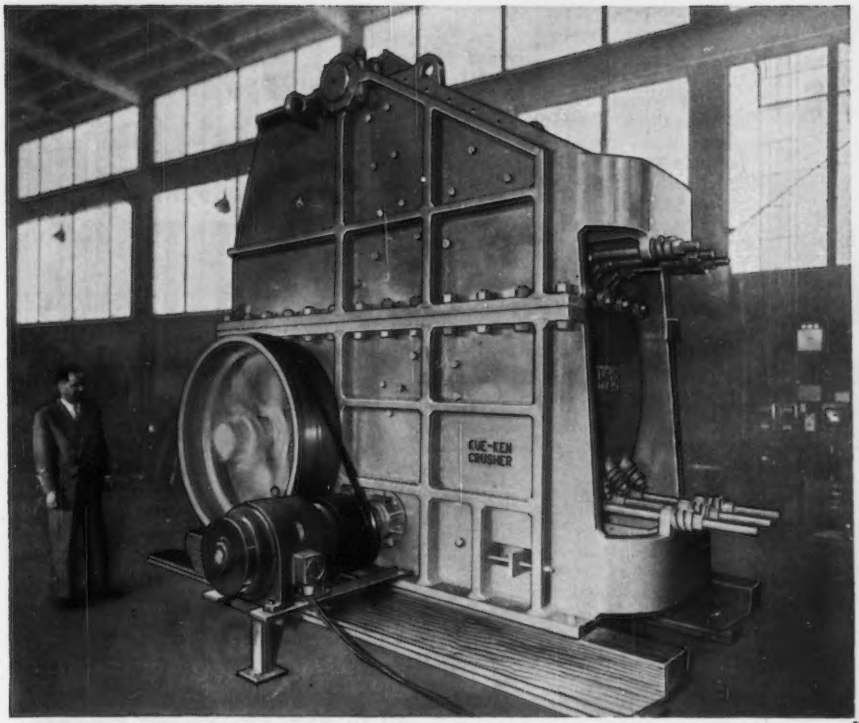
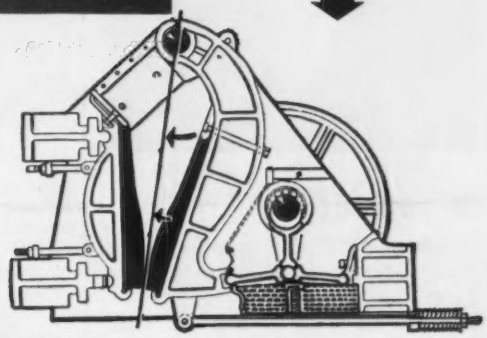


KUE-KEN "crushing without rubbing" lengthens jaw plate life at least 5 times! The pendulum type jaw supported on a stationary hinge pin in center line of the crushing zone swings in an almost straight line to crush rocks squarely without rubbing. This eliminates the main cause of premature jaw plate wear with conventional crushers. The four KUE-KEN jaw plate sections of the massive 48" x 42" KUE-KEN (above) are reversable and interchangeable for maximum utilization. With KUE-KEN, jaw plates cease to be a major maintenance and downtime factor.

KUE-KEN crushes at greater speed for higher capacity and a more uniform product!



KUE-KEN provides the lowest cost-per-ton crushing. With a pendulum type swing jaw providing maximum leverage where it counts most—at the top of the jaw for crushing large rocks, the smooth running, efficient KUE-KEN operates at greater speeds for higher capacity and a more uniform product.

KUE-KEN saves on power. By "crushing without rubbing", KUE-KEN uses its power to crush rock, not to wear out jaw plates as with conventional crushers. With no heavy reciprocating parts to lift, the KUE-KEN pendulum type swing jaw is driven by a single lightweight flywheel powered by a normal duty squirrel cage motor. In shop test, the 48" x 42" KUE-KEN crusher above is started by a 30 hp motor with a single vee belt and runs mounted on skids not fastened to the floor at the operating speed of 275 rpm on only 17 hp!

KUE-KEN precision machined toggle mechanism operates in a sealed, filtered oil bath to reduce wear and friction to the absolute minimum. Power that is wasted in non-sealed, dirt-catching mechanisms is fully utilized by KUE-KEN in crushing rock.

KUE-KEN provides positive protection against damage by tramp iron. An automatic, adjustable safety release integral with the flywheel ends shearing or breaking parts. Production is resumed in minutes.

33 sizes of KUE-KEN Crusher are available from 12" x 7" to 48" x 48".

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Jaw Crushers **Gyratory Crushers** **Revolving Screens** **Overhead Eccentric Crushers** **Classifiers** **Feeders** **Rib Cone Ball Mills** **Concentrating Tables** **Vibrating Screens**

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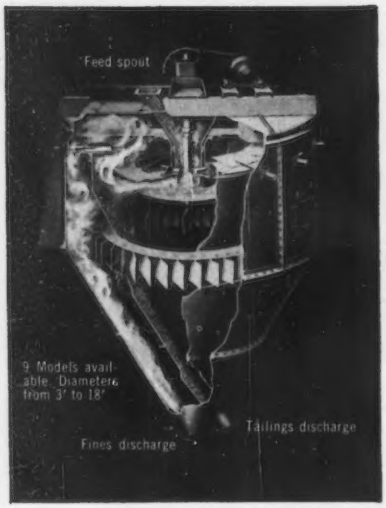
In Cement and Aggregates the Word for Air Separation is "Sturtevant"



in cement . . .

Sturtevant Air Separators make possible highly efficient closed-circuit systems. Large circulating loads increase output, eliminate overgrinding. Ball and lining life lengthens, power costs are lowered. Top quality cement results from precise control of finenesses. Standard 16 ft. Sturtevants deliver raw fines up to 70 tph, finished fines up to 260 bph.

in aggregates . . .

Sturtevant Air Separators classify sand without water, clean sand by de-dusting it. Pre-classification by air can also increase screening production by removing screen-blinding fines. In blending operations, Sturtevants select desired fines from grinder throughput. This graded product is then used to overcome fineness modulus deficiencies.

Send for Air Separator Bulletin No. 087.

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Crushers • Grinders • Micron-Grinders • Separators
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Mexico *(Continued)*

intensifying its exploratory and development work in the Isthmus of Tehuantepec for developing the anticipated iron reserves there.

The zone around "La Perla" in the northern state of Chihuahua is also under development for iron mining. According to the president, finds in both areas have given new reserves totalling 60-million tons, a 20% increase over last year's nationally known reserves.

Lopez Mateos did not mention the expected revision in the mining law which would reportedly demand Mexican ownership of mineral producing properties. (June 1960, p369)

Fluorspar mining in northern Mexico is gathering into a medium-sized boom, according to chemical company executives in Mexico City. If the latest move works out, du Pont Co. and Dow Chemical Co. will combine forces to mine, mill and ship spar from the area.

The list of other fluorspar miners is growing fast. Operations either under way or in advanced planning stages include: Dow, du Pont, Noranda Mines of Canada, Stauffer, Allied, Asarco, Aluminum Co. of America, Pennsalt, Continental Ore, Reynolds Metals Co., and Union Carbide.

IN EUROPE

USSR

The Soviet Union has announced development of a high-frequency electric rock crusher which can break up 12 tons of iron ore in three minutes. According to the Mining Institute of the Soviet Academy of Sciences, the technique is based on so-called high frequency puncture.

In tests, the device broke up chunks of ore three times faster than drilling and explosion methods, the academy claims. And it does not cause silicosis-producing dust. There are no plans at present for commercial use of the rock crusher.

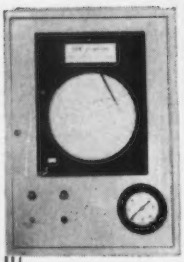
Russia has launched a "new branch of engineering," the construction of gigantic earth-digging machines to work the shallow deposits of iron ore and copper discovered in the country.

Soviet news agency TASS reports that mass production has started in the Ukraine of continuous-rotor excavators with 1,000 cu m per hr capacities. At the Novokramotors plant 3,000 cu m per hr rotor excavators, earmarked for stripping operations at particularly rich deposits, are already in production.

Kasakh scientists claim development of a process for producing combined mineral fertilizer - molten magnesium phosphates in a cyclone furnace.

The Kazakh Academy of Science's Institute of Chemistry has smelted phosphorites with the mineral astrachanite as an additive in a cyclone furnace designed for smelting copper concentrates. This technique is described as "highly

CONVEY WEIGH and CONTROL



your product with one integrated operation

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The CON - O - WEIGH system can be installed as a simple weigh-belt mechanism or it can function as a process control system for conveyor-carried bulk materials. Equipped with variable-speed drive and an automatic speed compensation feature, CON - O - WEIGH is ideally adapted to complex feeding, blending and proportioning operations.

Its basic parts are simple . . . weigh section, load cell and control cabinet. Its application broad . . . records accurate running totals on loads of one to 5000 tons per hour.

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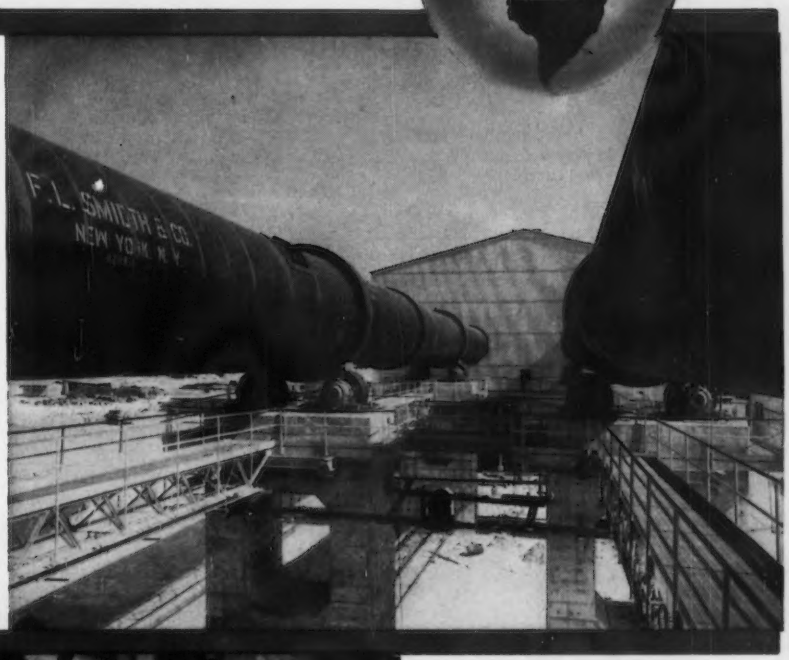

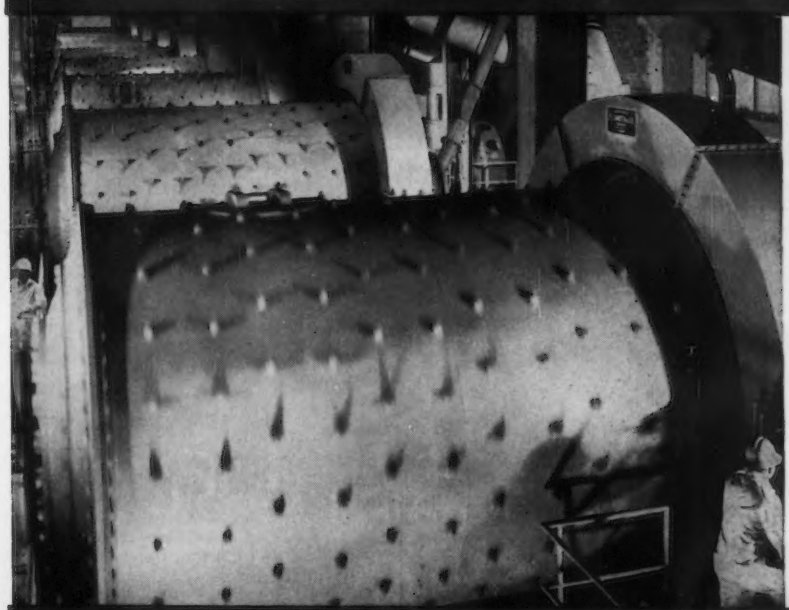

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USSR *(Continued)*

efficient . . . easily lends itself to automation." The mineral fertilizer obtained from the process contains only half as much phosphoric acid as conventional superphosphates and requires no sulphuric acid for its manufacture, the Soviets say.

HUNGARY

Hungarian scientists have designed and built a portable 24-channel seismic installation that can be carried by eight men. The unit has its own 12-v power system, main and auxiliary equipment, and spare parts for setting up seismic teams in roadless, mountainous territory. Main equipment consists of recording gear built together with the phone amplifier, a turning-fork generator and a feed unit.

ITALY

In the first six months of 1960, Italy produced 31,868 tons of aluminum pigs, as against 28,087 tons produced in the corresponding period of 1959.

Italy's aluminum exports for the first six months of 1960 were 4,435 tons, value $3,219,200, as against 8,528 tons, value $5,240,000, during the corresponding period of last year.

IRAQ

Soviet mining engineers will start extensive surveys of ore deposits in the northeastern, northern and western areas of Iraq in October, it has been officially announced in Baghdad. The surveys will cover ferrous and nonferrous metals, as well as sulphur and phosphate deposits.

Under the Iraqi-Soviet agreement of March 1959, the USSR will provide survey equipment as well as technicians and foremen to carry out the work. The equipment and some of the Soviet experts are already in Iraq.

GOSH! ALL THOSE ADVANTAGES IN
BEMIS SAFETY YELLOW
NYPRENE
FLEXIPIPE®
Yep, count 'em. Compare Flexipipe with any metal ventilating tubing and you'll confirm this check list . . .
• LABOR INSTALLATION COST FAR LESS.
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IN AUSTRALIA

Copper mining revival in the State of New South Wales, Australia, is likely, if the Cobar Mines Pty. Ltd. proceed with their plans to acquire the interests of Enterprise Exploration Pty. Ltd. Over $2.4-million has been spent in the Cobar area on exploration activities. The N.S.W. State government is assisting by its consent to lower royalty rates.

Consolidated Goldfields of South Africa Ltd., based in London, England, has taken a 54.4% interest in Commonwealth Mining Investments (Australia) Ltd., Australia's largest mining investment company.

Nippon Mining Co. is preparing to spend over $2-million to build a treatment plant in Queensland, and to guarantee spending about $1.3-million a year on local copper purchases. The Japanese company's representatives have finished examining a potential area of interest, comprising some 30,000 sq miles, in Queensland.

Montana Silver Lead N. L. in Tasmania failed to interest other companies in its properties and plant, and will be liquidated soon because of lack of capital for further work.

IN AFRICA

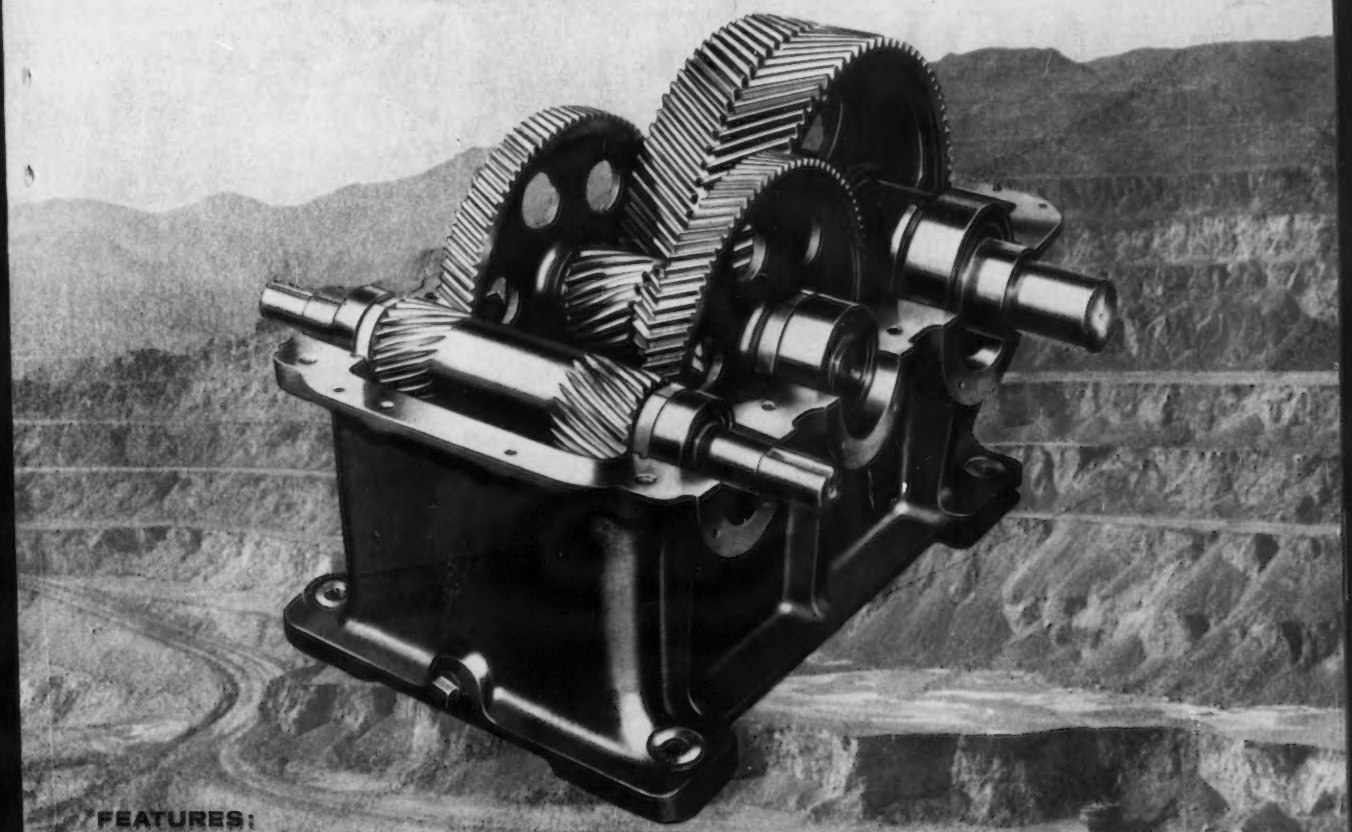
The High Commission territory of Swaziland is exporting beryl for the first time in its history. Production is small, however, amounting to less than 3 tons last yr.

The Southern Rhodesian government has agreed to the remission of all royalties payable during the year ended Sept. 30 on chrome obtained by Rhodesian Cambrai Mines Ltd. from its mining locations in the Gwelo mining district of the territory.

The Mufulira mine in the Northern Rhodesian copperbelt has set a new shaft-sinking record. The main ore-

on the long run... QUALITY COSTS YOU LESS!

Quality does cost less on the long run when you specify **WESTERN GEAR** SpeedMaster reducers because only the Western Gear SpeedMaster line gives you all these features*. SpeedMaster reducers are designed with the specific requirements of the mining industry in mind. They are available in any shaft arrangement, horizontal, vertical, parallel, in-line or right angle with ratings up to 10,000 hp in any desired ratio. Why not get the full story now on these profit-making, maintenance-minimizing SpeedMaster reducers. Write for Engineering Bulletin 5802.



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GREATER BEARING CAPACITY assures greater than standard bearing life. You do not pay a premium for this in Western Gear's SpeedMaster.

STANDARDIZED back stops, outboard bearings and bed plates.

DOUBLE HELICAL hardened steel gears symmetrically arranged provide better, balanced loading.

PINIONS INTEGRAL with shaft provide maximum strength.

RUGGED cast iron housings prevent distortion under heavy loads.

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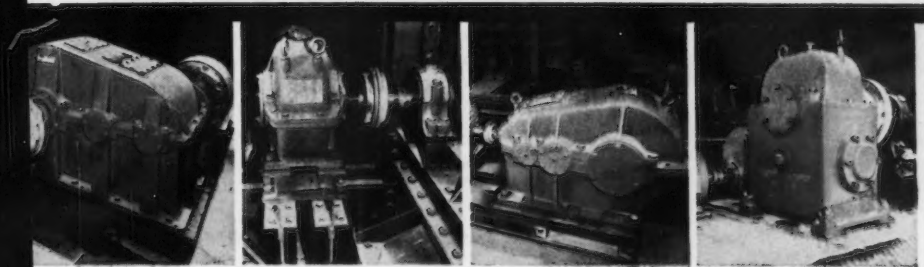

WESTERN GEAR CORPORATION
Industrial Products Division
P.O. Box 126, Belmont, California
Please send Bulletin 5802.

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WHAT WOULD HAPPEN IF ALL ADVERTISING STOPPED?

Stores would begin cancelling orders. Very quickly, manufacturers would close down plants and lay off millions of employees. Volume production would be a thing of the past . . . and so, prices would rise fast.

Within a week most radio and television stations would close up shop for lack of revenue. The ability of many newspapers and magazines to perform their full, vital functions would be seriously impaired. And the cost per copy would zoom for those that tried to keep running only on circulation revenues.

This alternative to advertising can hardly be the goal of the critics of advertising. Without advertising our national economy, our national *life*, would be bleak indeed. In many ways, advertising is the *power plant* of our society.

MORE CUSTOMERS FOR MORE PRODUCTS—American creative genius and wonderful ability for organization have resulted in a tremendous flow of goods of all kinds. This creates a crucial need for *masses* of people anxious, willing and able to *buy* and *consume* these goods. Only a society with a constantly *rising* standard of living can provide the customers. These customers have to be sought, taught and often *persuaded* to move higher in the scale of living. This is the job of advertising.

Advertising not only gives people news about new products, but provides the *urge* for people to own and enjoy these products. The wider and deeper the penetration of our products into the life of America, the greater the need for more production. This means more jobs. More jobs mean more people able to enjoy what we make. More people buying means more, still more production. And so on and so on. The result is that more Americans can enjoy more of the fruits of their labor than people in any country anywhere in the world can enjoy theirs.

ADVERTISING LOWERS PRICES—Does advertising raise the cost of goods? On the contrary. Through newspapers, television, magazines, radio and billboards, an advertiser can talk to a prospect for a tiny fraction of a cent. Advertising is the quickest and cheapest way of reaching large numbers of people. It enables the advertiser to reach his market (customers) inexpensively and thus increase his total production, thereby reducing the cost of making and selling each unit.

THE CULTURAL EFFECTS OF ADVERTISING—It's because of *advertising* that our mass media of communication can afford to command the finest talent for bringing to the American people information, stimulation, entertainment and education which in other countries are available to just a very few people.

Advertising makes its cultural contribution in another way. Advertising is in large measure responsible for better living, less drudgery, more leisure for more people. This creates opportunities for intellectual and spiritual activities equaled in few, if any, other countries. While millions and millions of dollars are being spent by Americans for cars, boats, sports equipment and the paraphernalia of leisure, there is a growing *hunger* for improvement of the mind and for aesthetic enjoyment.

WHAT ARE THE "NEEDS" OF THE PEOPLE?—Critics of advertising sometimes indict it for creating dissatisfaction in people's minds with what they have, and persuading and cajoling them into buying what they neither need nor want. But what are "needs?" The "needs" of people in undeveloped countries are not the same as our needs. Our needs of 50 years ago are not the same as they are today. We don't actually "need" electric razors, electric refrigerators, vacuum cleaners, television sets, shampoos, beauty treatments, packaged goods, or even automobiles. But would the critics of advertising stop encouraging people to want a better life? Would they have the millions of people who create, produce, and market the so-called "non-essentials" thrown out of jobs? Do they want us to go back to the more primitive living of other countries?

ADVERTISING—PUBLIC SERVANT—Frequently, the advertising industry is called on to direct public-service jobs—for the Government as well as for private public-service organizations. This it does through the Advertising Council, a nonprofit organization supported by American business and advertising media. Here's what President Eisenhower said to the Advertising Council in Washington several months ago:

"For eighteen years you have been stimulating the nation's conscience in areas where the voluntary work of great numbers of people has been necessary in order to promote worthwhile causes. I know you have been in such fields as conservation, organized charities, safety, prevention of accidents, and more recently in giving your efforts to the job of pointing out to our people the need for self-discipline if we are to avoid debasement of our currency and prevent inflation.

"And I think no other body has done more in this regard in trying to inform America across the board of these things than The Advertising Council."

Africa *(Continued)*

hoisting shaft was sunk 415 ft in 30 days, as part of a proposed 2,950-ft-deep project.

Moroccan Mining Research Office technicians called lead mines discovered in the Moulouya Valley, north of Midelt, "the most important find in 30 years." Deposits were compared to those at Bou Beker on the Algerian border, which produced 30,000 tons of lead concentrate and 82,890 tons of zinc concentrate last year.

The research office plans to install a pilot filtering plant at Rabat in October, to determine the most economic method of treatment, prior to construction of a $4-million processing plant.

The Moroccan government has intensified its search for pyrite in the Atlantic Coast region of Safi, in connection with plans for establishing a chemical-industry complex in the area. Reason for the prospecting activity is the up-coming 110,000-tpy ammonium phosphate plant in Safi, scheduled for completion in three years. And at the same time, the government has extended feelers for the construction of a triple superphosphate plant in the same location.

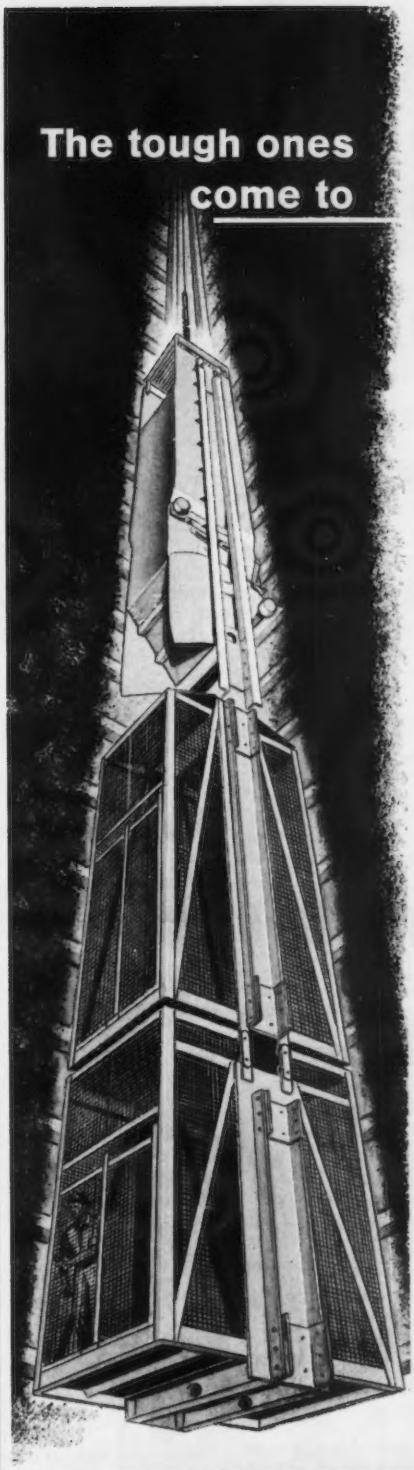
Potassium deposits in the region of Khemisset, 40 mi east of Rabat, were discovered recently by Morocco's Mining Research Office, in cooperation with the Mines Domaniales de Potasse d'Alsace. Reserves were described as "enormous." The French company and the Moroccan government are now setting up a new firm for exploitation of these deposits.

The first shaft intersection has been made at Leslie, one of the new mines being developed by the Union Corp. group in the Kinross area of the eastern Transvaal. The mine's directors have announced that No. 1A shaft intersected the Kimberley Reef at 1,476 ft below the collar, and that sampling around the whole perimeter gave 80.9 dwt over 5.6 in.—the equivalent of 453 in.-dwt. Full-scale sinking of the shaft started in April, but was delayed when water-bearing fissures were intersected. No. 1A shaft is in the southern half of the lease area, adjacent to No. 1 shaft.

Recent announcements by the directors of the mine indicate that though there are many uncertainties still to be faced in its development, it might be possible to start trial-milling in the fourth quarter of 1962 or the first quarter of 1963.

The South African gold mining industry has announced yet another record value from one month's output—the August production figure is 1,815,488 oz, about 350 oz. less than the record output, achieved in July. But with a rise of about 2½c per oz in the selling price of gold, the August value was $63,437,000, compared with the previous highest figure of $63,429,400, recorded in June.

The continuing program of research in the gold mining industry cost about $4.8-



Copper-Silver Mine Boosts Tonnage with Card Automatics

At Wallace, Idaho, a small shaft is producing up to 12,000 tons of silver-copper ore per month using Card automatic bottom dump skip-cage combination. Skips are rated at 125 cu. ft., handling 16,000 pounds per trip. The ore pocket is kept filled with Card cars, both rocker-dump and Granby types. Surface haulage utilizes larger Card cars, 60 cu. ft. Granby type.

Each skip weighs only 7300 pounds —about 45% of payload—a large increase in payload ratio. The second cage permits transport of twice as many miners, effectively cutting labor costs. Card combinations can cut your hoisting costs in small or large operations.

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for Conveyor Belts that must be extended or shortened

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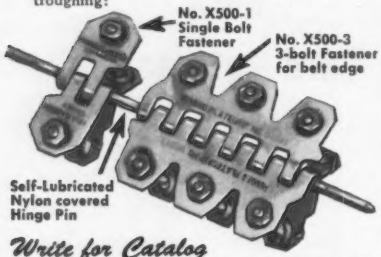

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Africa *(Continued)*

million last year. This total does not include sums spent by government and other institutions interested in the safe and economic development of the industry.

The Government of Southern Rhodesia has granted prospecting orders to three companies. Rio Tinto (S.R.) Ltd. is to prospect for precious stones, metals and base minerals in about 10 sq mi, and must spend $21,000 in two years. Johannesburg Consolidated Investment Co. may prospect for gold and antimony for two years in an area of 34.25 sq mi. Vulcan Minerals may search for precious stones, metals and base minerals for two years over 20.4 sq mi.

PHILIPPINES

Cebu Mining Corp. has signed an exploration agreement with A. Soriano y Cia. covering its lead-zinc-copper claims in Cebu. The property contains a well-defined 10 ft wide silver-lead vein extending 1,500 ft.

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LETTERS

Dear Sir:

My attention has been called to an item in the August issue of Engineering and Mining Journal which both is factually incorrect and gives rise to false inferences. I refer to the column headed Washington Impact on p20 of the August issue which among other things states as follows: "Moreover, say Kerr confidants, Mexican importers — represented by former Interior Secretary Oscar Chapman, a Johnson supporter—are privately saying they can accept the Kerr duty increases. The damper on this possibility is the threat of an Eisenhower veto of Kerr's bill." To begin with it is entirely in error to state that I represent Mexican importers. The fact is that I do not. I do represent Mexican producers of lead and zinc, and as you know or should know, the position of the two groups is not identical in all respects.

Furthermore, I am afraid that the quotation is calculated to create the impression that the Kerr bill duties might be acceptable to the Mexican producers of lead and zinc. Such a conclusion would be entirely false. The Mexican producers of lead and zinc have from the very beginning stated their flat and unequivocal opposition to such duties. Our position has not changed. No one has been authorized to advise your correspondent or anyone connected with this legislation to the contrary, and I am confident that no one associated with my office or with the Mexican lead and zinc producers has done so.

Oscar L. Chapman
Chapman, Wolfsohn and Friedman
Washington 4, D. C.

E&MJ regrets the misinterpretation of the word "importers." It was used to connote foreign suppliers in the August Washington Impact. But we plead not guilty to the charge of false inferences regarding the attitude of Mexican producers toward the Kerr Bill.

Reliable sources reported to E&MJ's Washington staff that congressional committee staffers learned from Mexican producers that the higher import duties called for in the Kerr tariff proposal would be preferable from their standpoint to a continuation of present import quotas.

As reported, their view was that the Kerr tariffs would have the net effect of raising U.S. lead and zinc prices, to the benefit of foreign as well as domestic suppliers, and that this benefit would more than offset the penalty of higher import duties.

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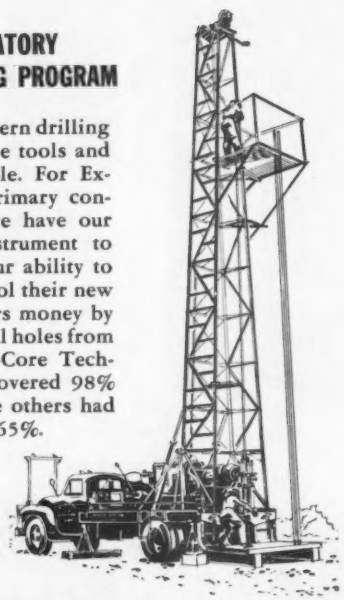

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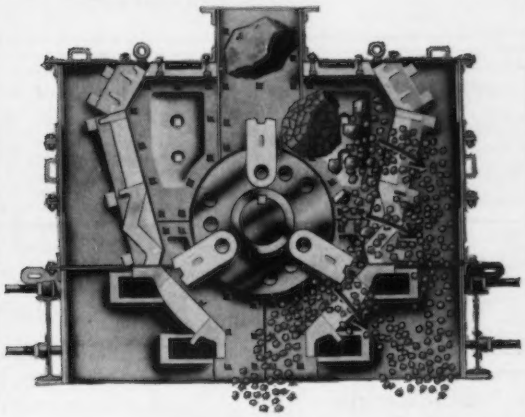

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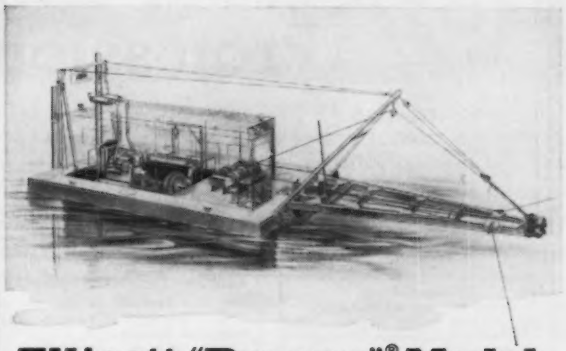

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1—6' x 7' x 100' rotary kiln, ½" shell
1—6' x 52' Bonnet dryer

MILLS—CRUSHERS

1—Kennedy 7' x 9' ball mill 150 HP
1—Hardinge 10' x 48' conical ball mill
2—Hardinge 7' x 36" conical pebble mills
3—Hardinge 6' x 48" conical ball, 75 HP
1—Hardinge 4'6" x 16" conical ball mill
1—Allis-Chalmers 5' x 5' ball mill, 75 HP
3—Allis-Chalmers 5' x 22' ball-tube
1—Allis-Chalmers 6' x 16' ball-tube
8—Jaw Crushers: 20" x 6", 18" x 9", 36" x 15", 13" x 24", 10" x 8"

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72" x 50", double drum, 400 H.P.
72" x 64", double drum, 400 H.P.
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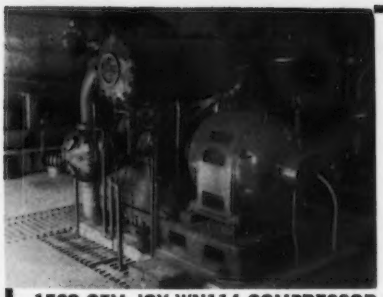

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33—31 cu. ft. C.S. Card Rocker dump, 24" ga.
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1—6' x 23'4" Dorr Duplex Rake, Model DSF, 5 H.P.
4—7' x 25'6" Dorr Duplex Rake, Model DSFX, 10 H.P.
1—36" x 12'8" Denver Spiral
3—6' x 20' Dorr Duplex Rake, Model DSD.

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1—2500 cfm Sullivan, Class WN4, 2200 V.
1—1528 cfm Joy, WN114, 300 H.P. 2300 V. Exc.
1—Joy WG9. 12 x 9. Less Motor

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8—24" dia. Humphrey Spirals, 5 turn
12—#6 Deister Diagonal Deck, 2 H.P. motor
5—#14 Deister Diagonal Deck, 1½ H.P. motor

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1—2¼ x 3 Braun Chipmunk, 2 H.P.
1—10" x 30" Pacific Jaw, 40 H.P.
1—15" x 36" Universal, 50 H.P. 440 V.
1—4' Symons Standard Cone, 75 H.P.

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1—8 cu. ft. Bucyrus Erie Bucket Line, w/ Pan. Am. Jigs, trommel screen.

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1—3' x 6' Jeffrey Traylor Grizzly Pan, 440 V.
1—36" x 8'4" Link Belt, Apron type, ½" Pans.
1—48" x 8' Link Belt Apron Feeder, type B.

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1—6' 4 DISC EIMCO with complete accessories
1—6' 5 DISC American complete
1—4' 2 DISC EIMCO ½ H.P. Reeves Varidrive
1—6' 6 DISC EIMCO with accessories
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4—6 cell #18, 28" x 28" Denver "Sub A"

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1—40 H.P. Coeur d'Alene Jr. Single Drum
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1—75 H.P. Puget Sound Single Drum, Post Brakes
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1—FF311 Joy, 3 drum, 10 H.P. 440 V.
7—FF211 Joy, 2 drum, 10 H.P. 440 V.
2—30 NM3D Ing. Rand, 2 drum, 30 H.P. 440 V.
1—20 NM2C Ing. Rand, 2 drum, 20 H.P. 440 V.
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1—CF 211 Sullivan, 2 drum, 50 H.P. 440 V.
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9—L-111 Joy, 1 drum, Air

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1—1½ Ton Atlas, Type J, 24" ga. w/charger.
1—3½ Ton Mancha Type AN, Battery, 18" ga.
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1—4 Ton Mancha, Std AN, battery, 24" ga.
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1—8 Ton Plymouth diesel, w/scrubber, 24" ga.

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3—5' x 14' Marcy Ball Mills, 100 H.P.
1—6' x 16' Hardinge Conical, 50 H.P.
1—4' x 5' Colorado Iron Works, 30 H.P. 440 V.
1—7' x 36" Hardinge Conical, 100 H.P.
1—7' x 22" Hardinge Conical, 75 H.P.
1—7' x 5' Allis Chalmers, 150 H.P.

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5—GD9 Gardner-Denver 18" ga.
1—HL3 Sullivan, 18" ga. bargain
2—21 Eimco Rocker Shovel, 24" ga.

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1—4' x 12' Tyler Ty-Rock, F600
1—4' x 10' Tyler Hummer, 1 deck
1—4' x 8' Symons Rod Deck

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1—3½ yd. Marion 111M, with Dragline
1—3 yd. Marion Model 7200 Walking Dragline Diesel Electric
1—20B Bucyrus Erie Shovel, with 40' Dragline

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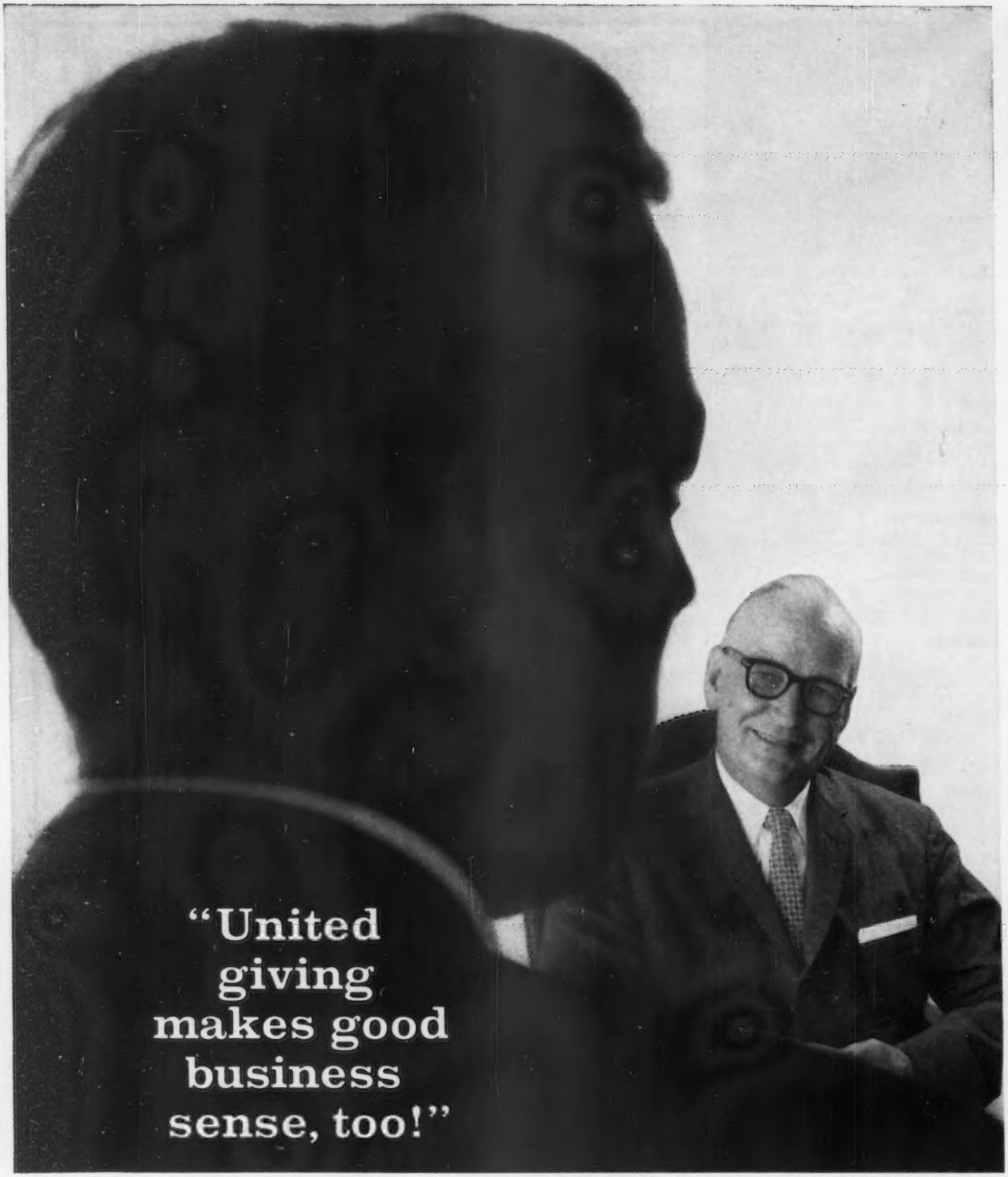

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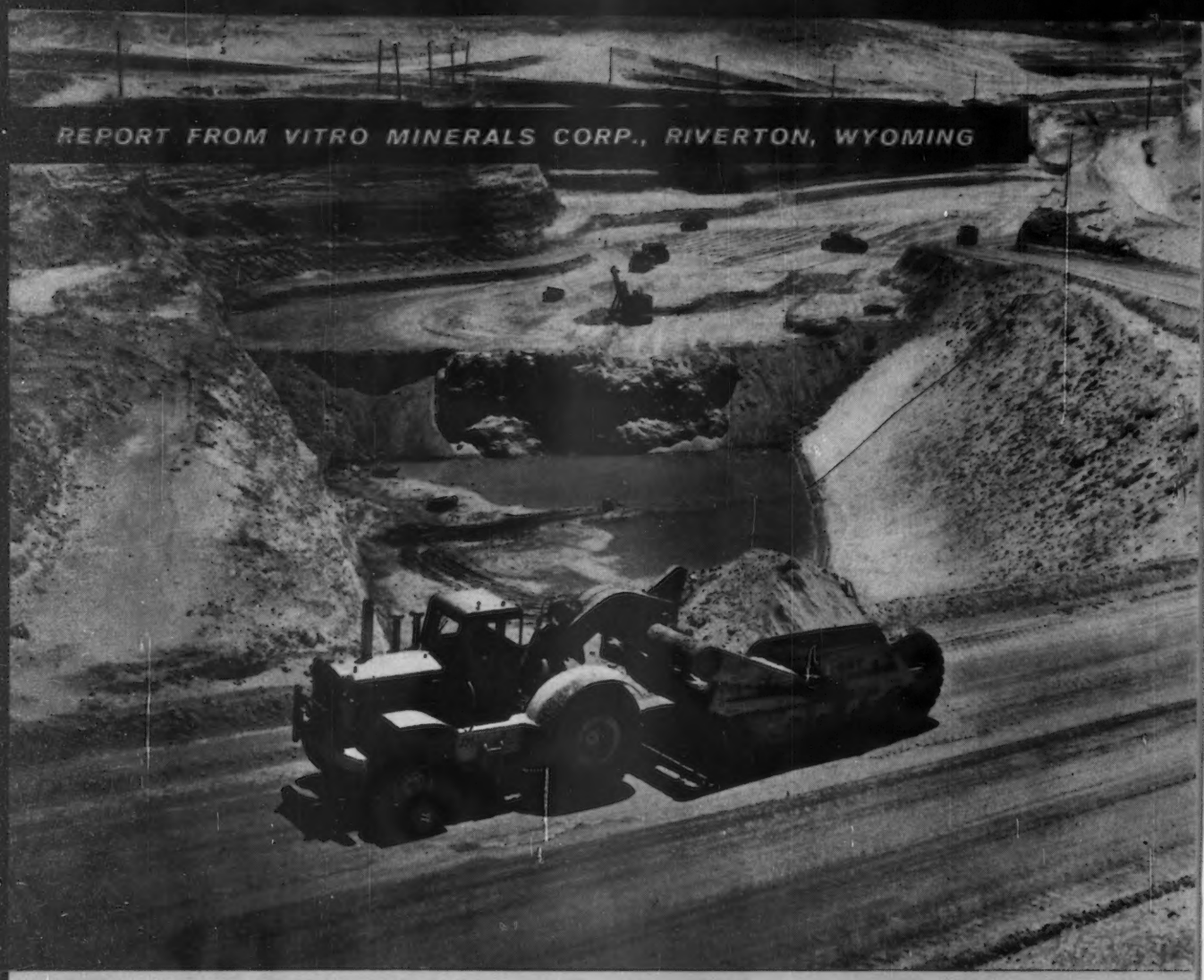

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